

Author: Pennsylvania Dept. of Forests and Waters

Title: Bulletin, no. 40 - no. 45

Place of Publication: Harrisburg, Pa.

Copyright Date: [n.d.]

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HOW TO PREVENT FOREST FIRES

By

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BULLETIN 40

Pennsylvania Department Forests and Waters
Robert Y. Stuart, Secretary
Harrisburg

SS

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DEPARTMENT OF FORESTS AND WATERS

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INTRODUCTION

Nearly everybody wants to prevent forest fires. Few would purposely start them. The fact is, however, that hundreds of columns of smoke from forest fires boil up toward the sky every year. Nearly every one who thru ignorance or carelessness has started a forest fire, is sorry. Perhaps he didn't think or didn't know how to prevent it. Possibly such unexpected circumstances occurred, as "the wind arose," or "a whirlwind came." Many forest fires start in this way from well-intentioned activities such as clearing new ground, burning brush or right of way, lumbering, railroading or camping.

On the other hand many land owners, tourists and farmers recognize the fire danger and realize the damage forest fires can do. Such men want to know how to protect woodland from forest fires likely to be started by others.

For these people this paper has been written. It presumes that no argument for forest protection is necessary. It tries to help the uninformed and to answer the inquiring. We have been preaching forest fire prevention and I have attempted to suggest definite methods of accomplishing it.

January 15, 1926.

CHAS. R. MEEK

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HOW TO PREVENT FOREST FIRES

IMPORTANCE OF EDUCATION IN FOREST FIRE PREVENTION

Forest protection is the most important element in forestry practice in Pennsylvania today. No forest investment is reasonably safe until the size and number of forest fires are reduced to such an extent that forests have a reasonable chance to grow to marketability. The forest owner should have some idea of how to lessen his risk and then assume his fair share of the responsibility.

"Prevent Forest Fires—It Pays" is the slogan of the Department of Forests and Waters. Thousands of posters have been tacked up in or near the woods warning against forest fires. Expensive signs have been erected, much literature distributed and many articles written calling attention to the same thing—forest fire prevention. The question naturally arises, "What can I do to prevent forest fires?"

CARELESSNESS RESPONSIBLE FOR MOST FOREST FIRES

Education of the individual to the importance of forest fire prevention is an enormous undertaking that cannot be accomplished by any one method nor in any given time. People are often too indifferent to the safety of the property of others, too unknowing of their own interests in the perpetuation of a great natural resource, too unmindful of their own future comfort. The average person is so different from his fellows that all cannot be reached and interested by the same means. Education, however, is the solution. "I must be as careful of fire in or near the forest as I am in my own home" must be the thought constantly hammered in.

"While it is true that it is the duty of the Commonwealth to take care of its own interests, both as a timber land owner, and because of the benefits of forests to society, it must be distinctly understood that the Commonwealth is made up of the individuals who live within its borders. The results of forest fires touch the life of every individual in the Commonwealth. It is the duty, therefore, of every citizen to do his share, not simply in the suppression of forest fires, but also in their prevention."

* * * *

"The only logical way we have of producing change in the human mind is by education."*

*Wirt, George H., "Lessons in Forest Protection." Bulletin No. 35, Pennsylvania Department Forests and Waters.

Ninety-nine per cent of the forest fires in Pennsylvania are the result of human action. The other 1% are lightning fires, (a very few may come from spontaneous combustion). Let us consider the general classification of causes of forest fires where preventable, and see what can be done to prevent them. The classification is:

- | | |
|-------------------|-------------------|
| 1. Incendiary. | 5. Transients. |
| 2. Railroad. | 6. Miscellaneous. |
| 3. Lumbering. | 7. Unknown. |
| 4. Brush Burning. | |

INCENDIARY FOREST FIRES

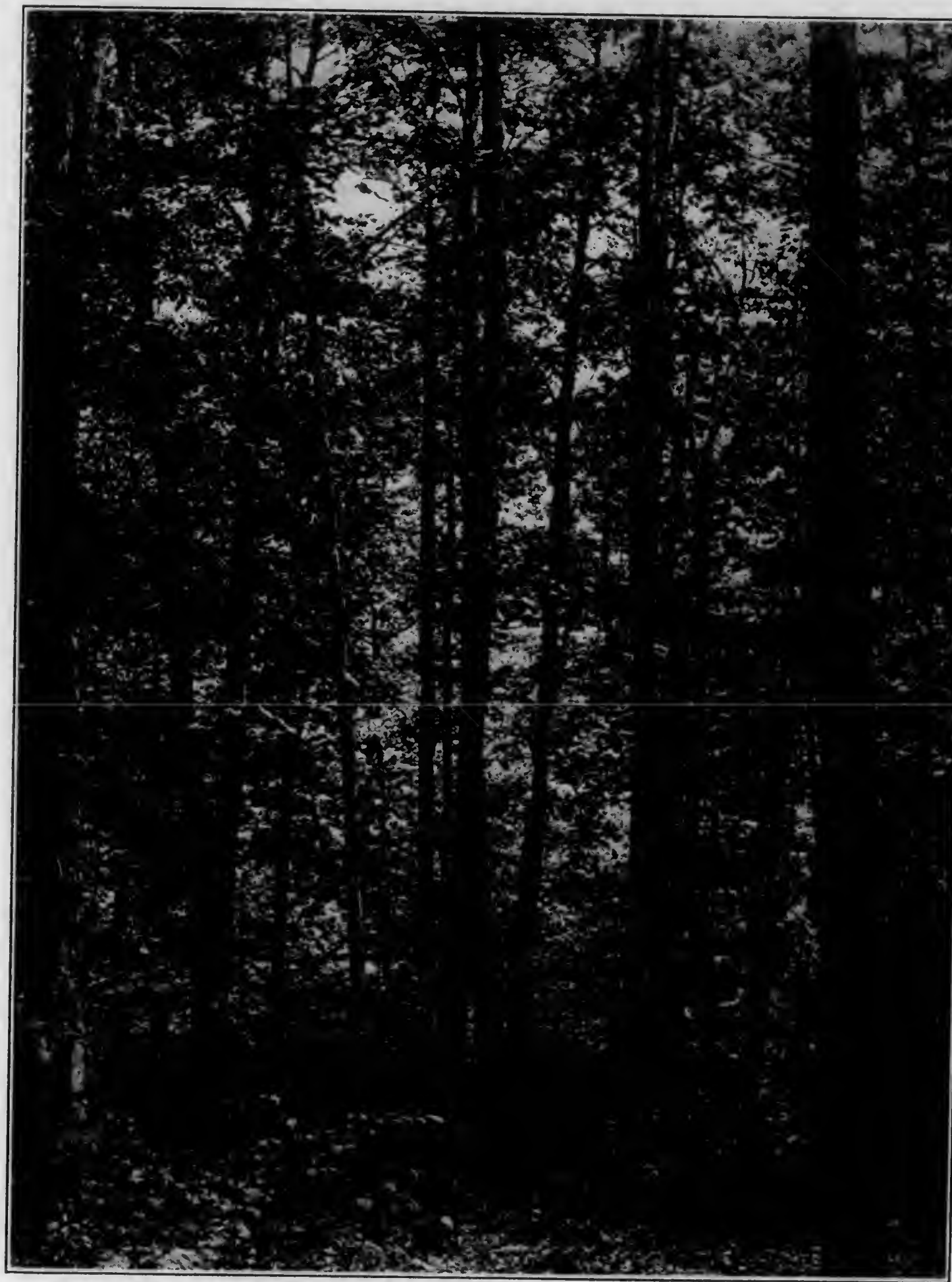
Forestry has no quarrel with the person who wishes to use his land for any useful purpose. For instance, the burning of "new ground"



MANY FOREST FIRES HAVE BURNED HERE

is not a forest fire but great care must be exercised that it does not result in one. If huckleberries are to be raised and an area is set aside and burned over by the owner or lessee under proper conditions, this too is not a forest fire, but he who for this purpose burns the land of *another*, without the consent of the owner, is an incendiary.

Incendiary forest fires are those resulting from the deliberate, intentional and malicious setting of fire for the sake of burning the woods for some reason or other (but does not include "back-firing" in



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good faith). Sometimes the "incendiary" starts a fire for some such purpose as improving pasturage or the production of berries. No one has a right to burn another's property, without his consent, for any purpose. Education will reach some of these individuals but mostly they are "old timers" whose ideas, we hope, will die with them.

The best way to prevent incendiary forest fires is to offer rewards for arrest and conviction and to display posters making the offer known; to catch the incendiary and make an example of him; to arouse public sentiment against incendiarism; to watch closely areas where incendiarism is suspected and put in patrolmen or detectives if necessary. In the spring of 1925 Josef Nonkosty was caught setting forest fires in York County and upon being convicted received a penitentiary sentence of from 2 to 5 years. The woman furnishing the information that led to conviction received from the State a reward of two hundred and fifty dollars.

In some localities the local people are refused hunting privileges and fires result. Where the cooperation of the natives in forest protection is sought by the land owner and in return the hunting privilege is allowed, it often results favorably, even tho strangers are barred from hunting. A rate of pay for fire fighting lower than the usual pay for laborers, or dependence on a regularly organized fire fighting crew is advisable where fires are started to secure work. In other words where certain conditions produce an unfavorable attitude in the mind of the incendiary it is well to remove or alter the conditions if possible.

RAILROAD FOREST FIRES

Railroad forest fires come from sparks from the engine stack, from hot coals dropping from the ash pan, from burning tie piles on the right-of-way, from hot tobacco or matches thrown from the train or dropped by workmen, from hot clinkers being thrown from the engine, or from sparks from hot brake shoes.

Much can be done by railroad companies through discipline in enforcing orders relative to preventing forest fires and by explaining to employees why fire prevention is necessary. The workmen should know what it means to the company and to themselves as well. Company and Government posters and notices warning against acts which might start forest fires should be displayed in engine cabs, smoking cars, bunk houses, tool houses, railroad stations, on bulletin boards and time tables.

Smoking car windows should be screened. All coal and wood burning locomotives should be equipped with effective spark arresting devices and with the ash pans so constructed that the doors cannot be opened or remain open while the engine is moving. Inspection, with definite responsibility, as to condition of spark arresters, and ash pans, reported under oath, should be made after each trip and repairs made

before the next trip. There should be repeated instructions to inspectors and frequent check up on their work by railroad officials. The company should permit inspection by employees of the Department of Forests and Waters when properly authorized.

The Safety Strip

To prevent forest fires starting from sparks which may escape from the engine a safety strip should be provided. A safety strip is an area from 100 to 200 feet wide through the woods adjacent and parallel to the right-of-way, burned over each year, thus providing a place where live sparks may fall and no forest fire result.



A DANGEROUS COMBINATION IF SPARKS FALL FROM THE ENGINE

The width of the strip and the necessity for it depend upon local conditions. The land owner, however, can do much, not merely by permitting the railroad company to make safety strips on his land but by insisting upon the railroad company's doing it and by assisting with the work. The principle of the strip is that it is far better to burn over a very small area under control than to have a larger area burn uncontrolled at any inconvenient time. Railroad companies are usually willing to do this work at their own expense where the land owner permits it. If one land owner refuses permission while his neighbors allow it, the owner can be compelled by law * to provide the strip at his own expense.

*Sec. 1617 (j) Adm. Code, June 8, 1923, P. L. 498.



MATURE FORESTS PROVIDE WORK AND PRODUCE REVENUE

How to make a Safety Strip

In the fall and winter the section men should go to the side of the proposed safety strip farthest from the railroad and scratch a clean path four feet wide in the leaves, of which width two feet in the middle should be bare to mineral earth, or if advisable burn a path two to four feet wide. This will usually stop most fall and winter fires coming away from the railroad. Early in the spring on dry calm days the section men going along the path previously made and with tools and water and ample labor at hand, (eight to ten men usually), start a back fire and allow it to burn over the space between the path and the railroad. Thus the safety strip is provided. It is not necessary nor is it

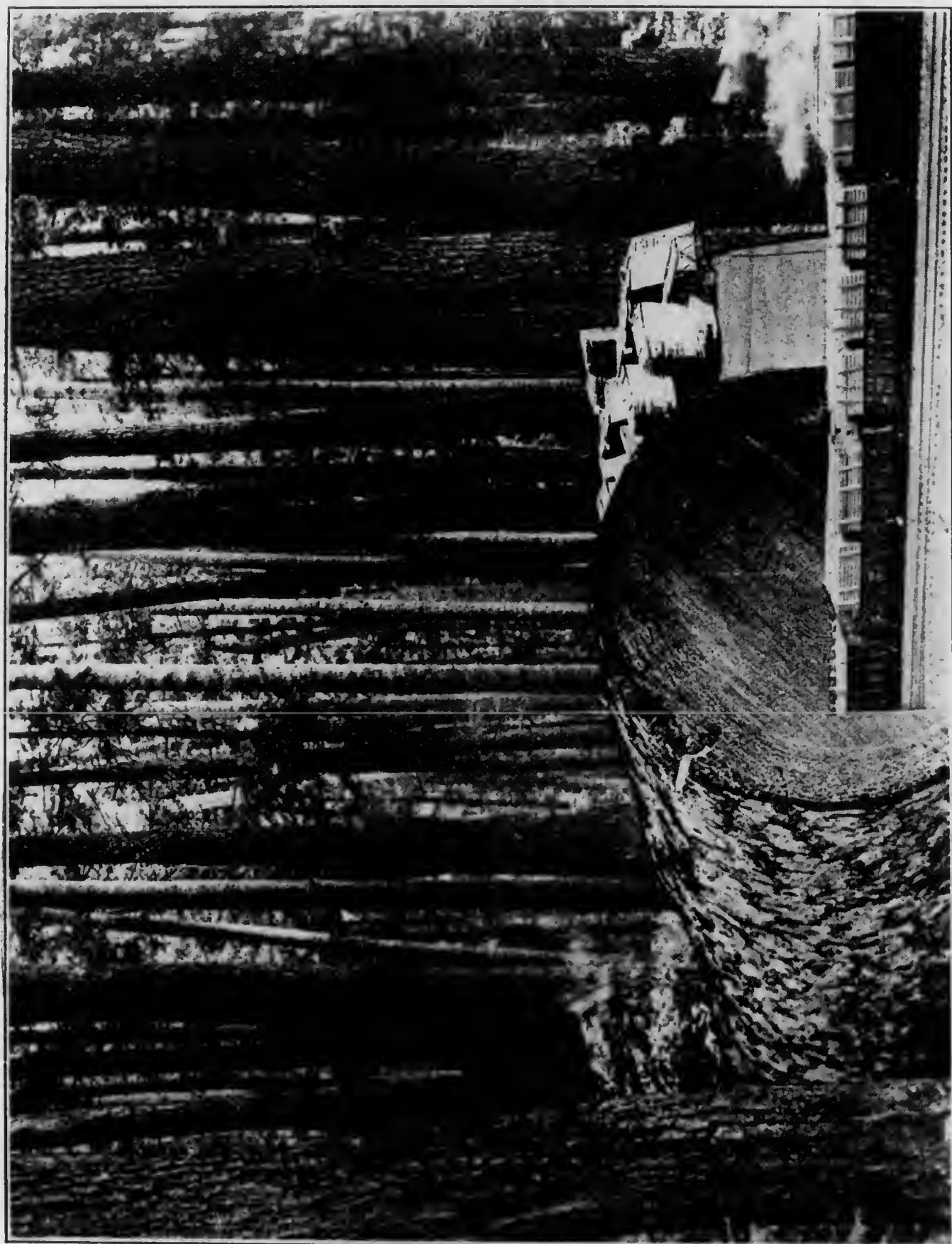


A WELL MADE BACKLINE

Photo by H. A. Smith

advisable to clean the safety strip of all wood growth. Only the dry leaves and ground litter are to be burned. The making of safety strips should be made a part of the regular work of the section men and the foreman should be held accountable if it is not finished by a certain date, for instance April 1st in the southern part of the State and April 15th in the northern part. The Superintendent could extend the time where unusual weather conditions make it necessary.

Forest fire season starts in the spring as soon as snow leaves the ground. The safety strip burning must start early but yet when dry enough to burn thoroughly, for if inflammable material is left a spark will set fire, making ineffective the cost and effort of constructing the strip. The southern sides of the hills dry first and should be burned



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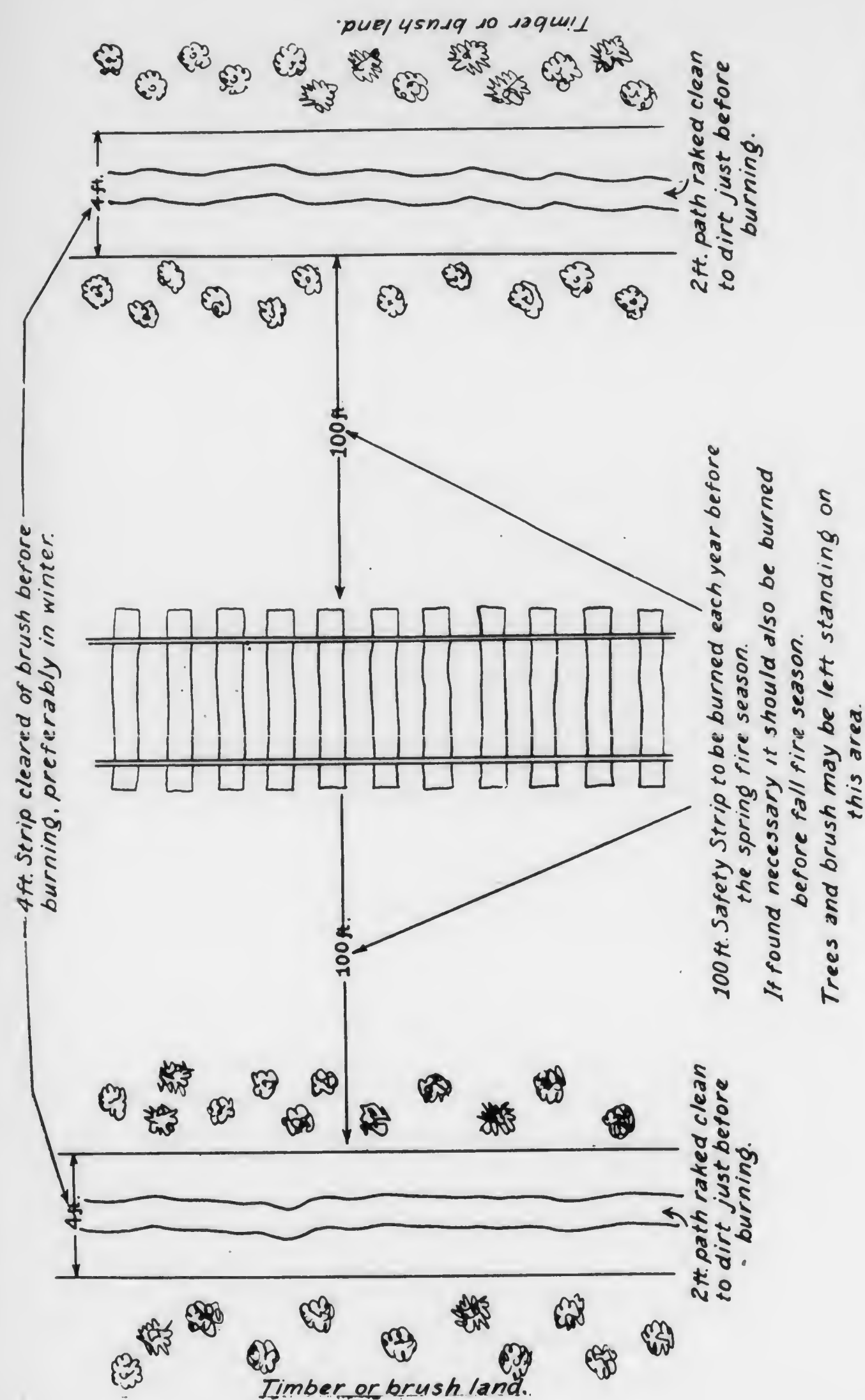


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Original by C. E. Baer.

DIAGRAMATIC SKETCH OF A SAFETY STRIP

first. The work must be pushed by long days with overtime allowance when the weather is favorable, if the work is to be finished on time. Proper equipment used in burning safety strips is a supply of Rich forest fire tools, brooms, torches, spades, sprinkling cans, buckets and water. The burning should always be from the up hill side *toward* the track. *Never* start fire at the foot of a slope. It will race up hill, jump your back line and escape.

Cost of Safety Strips

The first cost of making safety strips should not be over fifty dollars per mile, thereafter the upkeep should not exceed ten to twenty dollars per mile on one side of the track. It should be remembered however that if the burning is not thoroughly done at the right time the effort is wasted. There will be a "strip" but not "safety." Each year after the first the cost should become smaller as the amount of material to be burned becomes less and as the men acquire more experience. Railroad companies as rapidly as possible are being provided with charts prepared by the Department of Forests and Waters showing the degree of risk along the tracks with the places indicated where safety strips should be provided. As most tracks run along streams it is seldom necessary to provide a strip on more than one side of the right of way.

Experiments are being made with the planting of evergreen trees along the right-of-way in a strip 200 feet in width so that possible sparks may alight in green foliage and die out before reaching the dry leaves on the ground. This will probably prove an effective method of forest fire prevention when the crowns of the evergreens grow together and form a complete canopy.

Where Patrolling is to be Used

Where a railroad runs for miles through forest land, it may be too expensive to provide safety strips. In such cases and in cases where the strips have not been gotten ready in time, or due to weather conditions are not satisfactorily burned, it may be necessary to provide patrol. This should consist of two or three men on a speeder or the section men on a hand or power car following all trains on dry days. The men should follow not sooner than fifteen minutes after the train has passed and not later than one half hour, so that a smouldering forest fire will have time to give evidence of its presence by smoke, and yet not be so large as to be beyond control. This patrol, equipped with fire fighting tools can then extinguish promptly a forest fire before it becomes large.

One patrol should not cover more than five miles and on heavy grades the distance should be less. On small railroads where the train crew discovers the forest fire, the train should be stopped and the fire extinguished. All train crews, operators and station agents, should

promptly report all forest fires along the right-of-way to the nearest section foreman. The engineers often can throw a message on a special red tag to the next section gang giving notice of the location of a fire. The section foreman should be appointed a special forest fire warden by the State and be ordered by his company to extinguish all forest fires on or along the right-of-way and make a written report to the supervisor.



Photo by W. S. Taber

THE PATROL MUST BE VIGILANT HERE IF SAFETY STRIPS ARE NOT PROVIDED

Burning Ties

Ties, if they must be burned, should be burned only on the right-of-way on the side of the track where there is the least danger and then only in the summer after a rain, or in the winter when there is a light cover of snow on the ground. No more than ten ties should be burned in one pile. While burning ties, right-of-way, safety strips, or fighting a forest fire the section men should not leave the area, unless fire guards remain, until everything is absolutely safe. "No fire is out until the last spark is dead."

Dinner Time on the Fire Line

The lunches should be brought to the crew and should be eaten at the safety strip so as not to leave the danger unguarded. This is im-

portant since some safety strip fires escape when the men have gone away from the work to eat. Burning of safety strips ordinarily begins at 11 a. m. To stop at 3 p. m. and leave, allows too short a time to do much work on favorable days, which are few enough. The employees should be allowed overtime on good days and the work continued until dark. In the Weiser Forest District 45 per cent of the escaping fires occurred between three and four p. m., when the crews had left the fire lines unguarded or were hurrying with the work.

During the spring and fall the right-of-way should be kept clean so that no fire can burn upon it and escape from it.

FOREST FIRES FROM LUMBERING OPERATIONS

Lumbering has its own forest fire dangers that must be met. A safety strip with a radius 150 feet or greater should be provided



A SOURCE OF DANGER TO THE WOODS—STACK WITHOUT A SPARK SCREEN

about the saw mill in the same manner as described for the preparation of safety strips along the railroads. The sawmill engine should be properly screened. The locies or dinkey engines should be screened, and in dangerous places safety strips along tram roads should be provided and perhaps patrolled also on dry days. The section men, train and woods crews should have standing orders to extinguish all forest fires promptly. A forest fire warden should be appointed by the State for each camp. A signal of a number of blasts sounded by whistle should be selected to announce the existence of a forest fire.

All employees in camp and woods should be warned against forest fires, especially cautioned to be careful while smoking in the woods.

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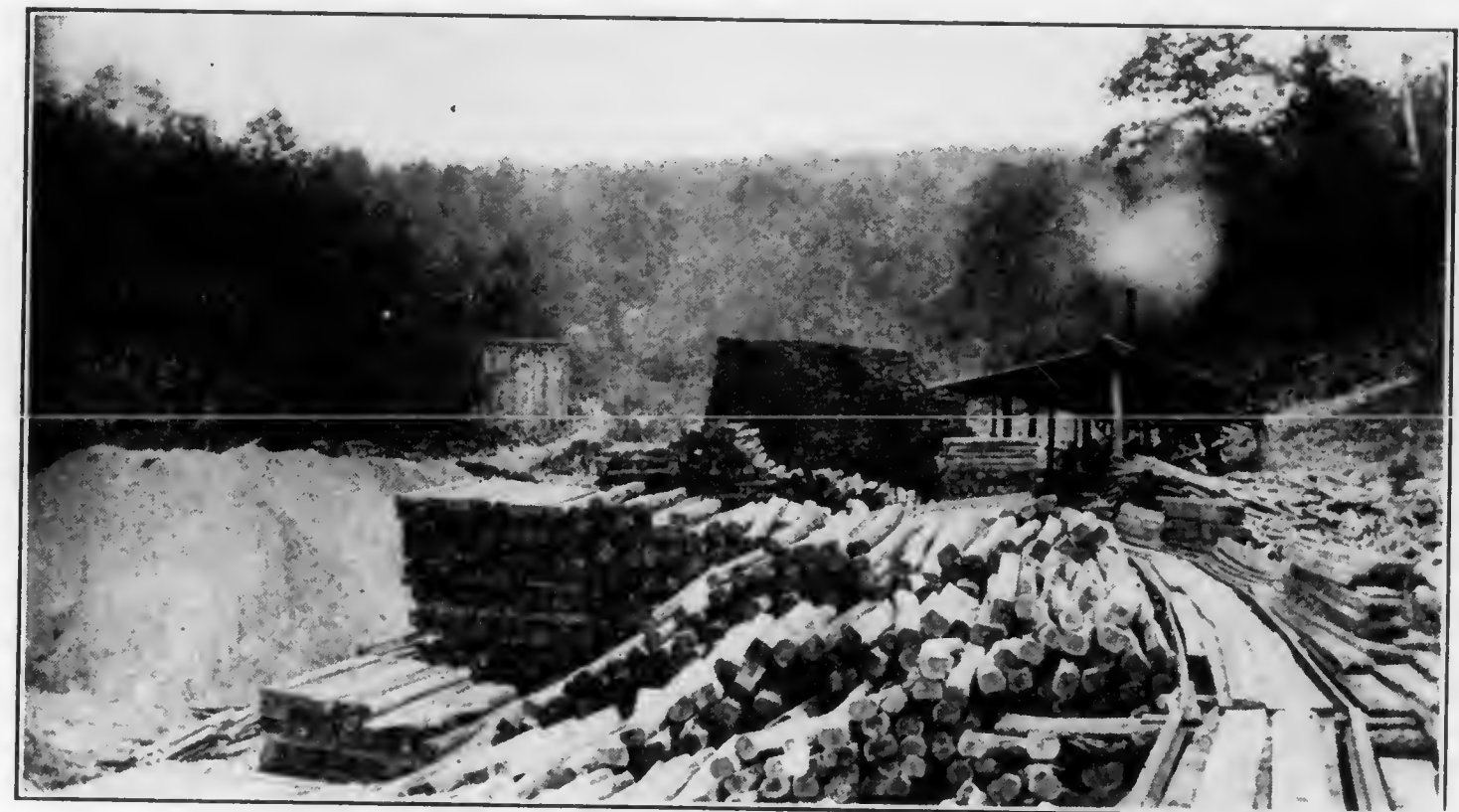
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All employees in camp and woods should be warned against forest fires, especially cautioned to be careful while smoking in the woods.

Posters warning against fires should be put on the bulletin board, in the dining room and lobby and also through the forest. Precautions should be taken that no forest fires result from the refuse burner or from chimneys, by providing proper screening, careful watching, and safety zones.

Supplies of forest fire fighting tools should be established in strategic positions known to the men. The list of tools should include Rich forest fire fighting tools, shovels, torches, lanterns, brooms, spray tanks and buckets.

Care should be taken with other engines, as loaders, donkeys, and pumpers in the woods, and the same methods of forest fire prevention



Photo by G. H. Wirt.
A HAZARDOUS CONDITION ALONG THE HIGHWAY

should be followed. Debris should be cleaned away from all buildings, especially the kitchen, so that in case sparks from the chimney escape no fires will result. This will also help protect the buildings from approaching fires and from fires started by the men's dropping hot tobacco while smoking about camp.

In lumbering or in any woods operation, where debris will result, no slash should be left within 100 feet of a steam railroad track, 150 feet of a sawmill or other engine, or within 25 feet of the edge of the traveled part of a public highway nor within 100 feet of the boundary line of adjoining woodland. Slash or debris in such position is a "forest fire hazard" and the owner of the land can be compelled by

TOOLS USED IN FOREST FIRE FIGHTING



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law* to remove it at his own expense. For this reason woodland owners should be particularly careful when selling the timber from the land to tie up the buyer or operator by contract in such a way that a hazardous condition will not remain after the lumbering is completed.

On some lumber jobs slash burning is practiced. When this is done a lane 10 feet wide should be raked about the entire area to be cleared of slash with a path in the middle of the lane two feet wide bared to mineral soil. Sufficient men, water and fire fighting tools should be on hand on a suitable calm day to handle the fire and to prevent its spreading to the adjoining woods. The fire should then be started along the path on the leeward side and allowed to burn against the wind.

BRUSH BURNING CAUSES FOREST FIRES

Brush burning includes burning of new ground, meadows, fence rows, weeds, paper, huckleberry ground and woods for pasture. In burning new ground or burning to improve pasturage and the huckleberry crop the same method of forest fire prevention should be followed as is given above in explaining the best method to burn slash.

Brush should be burned in an open field far from the woods and a few furrows should be plowed around the brush pile about 50 feet away so that fire running over the dead grass will stop at the furrow. No brush, or rubbish should be burned in the woods, nor within 200 feet of woodland. When rubbish is to be burned a day should be chosen when the air is calm. Plenty of men, tools and water should be on hand to control the fire should a wind arise, and if the wind does arise the fire should be extinguished at once. The material should be in *small piles* for burning and the ashes should be covered with earth.

It should be remembered that even on a calm day a fire creates its own draft and the fact that the "wind came" or "a whirlwind sprang up" is no excuse for the fire's escaping. If papers are to be burned they should be put into a wire paper burner, as burning paper and hot ashes are often blown long distances and cause "mysterious" fires.

When blasting in or near the woods great care should be taken to prevent burning fuses from starting fires after the explosion.

It is unlawful† to smoke game and for burning animals out of trees.

TRANSIENTS CAUSE FOREST FIRES

Transients are responsible for many forest fires. The automobile has brought the people so close to the woods that the transient population traversing forest land has multiplied many times. Carelessness by transients often results in fires. Following is advice that transients should heed, and which is effective in preventing forest fires:

*Sec. 1617 (j) Adm. Code, June 8, 1923, P. L. 498.

†Art. VI Sec. 603 and Art. VII Sec. 704 (a) 1923 P. L. 359.

a. Do not throw lighted matches or burning tobacco from an automobile nor any vehicle. Have a receptacle for this material in the car.

b. Break a match with the fingers after extinguishing it and before throwing it away. To extinguish burning tobacco in the woods scrape away the leaves to mineral soil, then tramp the fire out with the heel and cover the dead ashes with damp mineral earth.

c. A camp fire should be built only where the land owner permits it. Make the fire a small one in a pit in the ground or within a wall of stones, *never against a log or tree*. Scrape away all leaf



A BEAUTIFUL SPOT FOR AN OUTING MADE SAFE BY FIRE PLACE AND INCINERATOR

litter from about the fire. Do not leave the fire unattended. When leaving camp extinguish the fire by stirring the ashes while soaking them with water. If no water is at hand cover the ashes with damp mineral soil.

d. Do not throw away wet matches in the woods. They dry out and may ignite by someone's tramping upon them.

e. Never allow children to play with matches or fire.

f. Hunters should not build fires on runways nor for smoking out game.*

g. Never use inflammable wads while hunting.

*Art VI Sec. 603 and Art VII Sec. 704 (a) 1923 P. L. 359.

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b. Break a match with the fingers after extinguishing it and before throwing it away. To extinguish burning tobacco in the woods scrape away the leaves to mineral soil, then tramp the fire out with the heel and cover the dead ashes with damp mineral earth.

c. A camp fire should be built only where the land owner permits it. Make the fire a small one in a pit in the ground or within a wall of stones, *never against a log or tree*. Scrape away all leaf



A BEAUTIFUL SPOT FOR AN OUTING MADE SAFE BY FIRE PLACE AND INCINERATOR

litter from about the fire. Do not leave the fire unattended. When leaving camp extinguish the fire by stirring the ashes while soaking them with water. If no water is at hand cover the ashes with damp mineral soil.

d. Do not throw away wet matches in the woods. They dry out and may ignite by someone's tramping upon them.

e. Never allow children to play with matches or fire.

f. Hunters should not build fires on runways nor for smoking out game.*

g. Never use inflammable wads while hunting.

*Art VI Sec. 603 and Art VII Sec. 704 (a) 1923 P. L. 359.

- h. Bees should be smoked out with an especially prepared smoke box only, never use fire in the tree. †



Photo by J. S. Illick
THERE WAS NO SPARK ARRESTER ON THIS CHIMNEY

MISCELLANEOUS CAUSES OF FOREST FIRES

Miscellaneous fires are those arising from definitely known causes but which cannot be classified under other headings.

a. Engines on tram or narrow gauge roads should be looked after in the same manner as recommended for standard gauge roads. The same recommendations as to safety strip work and patrol will apply.

b. Owners and operators of tractors and traction engines should observe the same precautions when operating stationary engines in or near woodland as the ordinary saw mill engine operator should observe. They should also be familiar with the law of May 31, 1919, P. L. 354 which makes illegal the operation of a steam engine within 300 feet of any building unless the engine is equipped with an efficient spark arrester. The law of July 8, 1919, P. L. 741 makes illegal the operation of a traction engine or

†Art X Sec. 1005 as amended (a) 1923 P. L. 141.

portable steam engine, using wood for fuel, anywhere within Pennsylvania unless equipped with an efficient spark arrester; with a bonnet spark arrester having an oval top of No. 10 mesh twenty two gauge wire and sides of No. 6 mesh sixteen gauge wire; and shall at all times carry fire extinguishers or buckets.

c. Buildings in or near forest land should have screening in or over the chimneys to prevent the escape of sparks which might cause forest fires. The area about such buildings should be kept cleaned up and free from debris in order that no fires may reach the buildings when coming from the woods.

d. No toy balloons holding fire should be released. They are likely to cause fires anywhere either in buildings, fields or woods. No fire works should be set off near the woods nor sent up in the direction of woodland.

e. Fires in the forest resulting from broken electric transmission lines can be reduced to a minimum by keeping the right-of-way clean and free of inflammable debris. When the burning is to be done follow, in general, the method outlined for making safety strips. Cut a swath on each side of the right-of-way along the bare soil path. Start to burn from the upper side and let the fire run down hill.

FOREST FIRES FROM "UNKNOWN" CAUSES

Fires in the woods classed as "*Unknown*" are usually preventable. Some fires will start, the exact cause of which are unknown, but undoubtedly of these fires nearly all can be prevented.

WHAT YOU CAN DO TO PREVENT FOREST FIRES

As a wood land owner you want to know what to do to prevent fires. What you can and should do at practically no expense is to put up forest fire warning posters. Often these are most effective when printed with your name thereon. Transients will *know* you are interested in your property. Posters can be secured free from the Department of Forests and Waters at Harrisburg.

Several kinds are available, including a poster offering \$250.00 reward for arrest and conviction of persons causing incendiary fires.

You can take the proper precautions against starting forest fires by carrying out the suggestions given in this bulletin.

You can warn others against starting fires.

You can insist upon forest fire prevention upon the part of those operating engines, sawmills, and railroads, on or adjacent to your lands.

You can keep the dead trees cut out.

You can keep the roads and trails open, so that all parts of your woodland are accessible and in case fire does occur it can be reached promptly and confined to a small area.

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KINDS OF CARDBOARD POSTERS FURNISHED FREE BY THE
DEPARTMENT TO WOODLAND OWNERS
(Please order by letter)

You should know of the State Forest Service and its organization: how to cooperate with it and how it will benefit you most. Get acquainted with the district forester, the inspector, the towerman and the local forest fire warden. When intending to do something that will make a smoke near woods in the forest fire season, March 1 to June 1 and October 1 to December 1, call the nearest towerman and tell him about it so that there will be no mistake when he sees the smoke.

If a fire should occur do what you can to extinguish it promptly. Notify the nearest towerman and the local forest fire warden. If you do not understand how to extinguish forest fires, write the Department of Forests and Waters for a free copy of Bulletin 36, "Forest Fire Warden Manual."

Refusal to allow trespassing for hunting sometimes makes it difficult to get local co-operation in forest fire prevention and extinction. You must weigh the advantages and disadvantages of this course of procedure and do what you think best.

You can often do effective work in forest fire prevention by collecting damages from those who have burned your woodland; by collecting and giving evidence in forest fire cases which the Department of Forests and Waters is prosecuting. Often one instance of punishment meted to one careless person, when made known, will make many others careful. Some people can be reached in no other way than through drastic measures taken by the law.

While using fire you are responsible for that fire's becoming uncontrollable and resulting in forest destruction. Such responsibility means that you are liable for the damage resulting and may be arrested for the violation of the law prohibiting the causing of forest fires. In addition, a bill for the cost of extinguishing the fire will be presented to you by the Commonwealth.

COST OF FOREST PROTECTION

Each owner must determine for himself how far he can go financially into forest fire prevention. If a woodland owner has but a few acres surrounded by open land probably he would not be justified in other expenditure than his own time in forest protection. If the owner of 100 acres, he should keep a close watch on the woods and go to considerable personal effort as outlined in the foregoing, to prevent fires. He should clean up the woods himself, sell dead material, open up the roads and put up posters. If in a region where there is a Forest Protective Association he should join it. In fact 5c per acre per year would not be too much to spend in addition to his own time. Of course the value of the woods should determine the amount to be spent and if the forest is not stocked with valuable species, perhaps some planting should be done. If this is decided upon, the



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During the spring and fall forest fire seasons he would be justified in spending at least \$25.00 per 1,000 acres for lookout watchmen and



A THRIFTY PLANTATION PROTECTED FROM FIRE

other labor. Patrolmen who have been appointed local forest fire wardens by the State and have thus had the proper authority conferred upon them could also be employed to warn fishermen, hunters and other transients to be careful with fire, put up forest fire warning posters, clean out roads and trails, cut down dead trees, and make other needed improvements in the forest, and extinguish promptly any small fires that may be found. Transients on Saturday and Sunday afternoons and on holidays are especially likely to roam in the woods in large numbers and to start camp fires. Twenty five dollars more per thousand acres could well be spent in fire extinction, elimination of hazards and Protective Association dues

DON'T NEGLECT THE WOODLAND

Neglected woodland is usually regarded by the public as having no owner. The measure of respect and interest people show one's property is that shown by the owner himself. Make your forest look as if some one owned it, and prized it highly, and the reward will be accordingly.

Every year there are from 2,500 to 3,000 forest fires started in Pennsylvania. One may start in dry weather anytime, therefore the owner of a large tract should be interested in having his land under the watchful eye of a towerman in one of the State's forest fire lookout towers where fires are detected and reported promptly to the extinction forces. He should find out where the nearest tower is and if not close enough to give adequate supervision he should offer to cooperate financially and otherwise with the State in erecting and maintaining



FOREST PROTECTION GUARANTEES FOREST PRODUCTS

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The forest owner should not allow forest fire hazards (see page 16) to be created or maintained on his land or the lands nearby, whereby his own woods may be endangered. He should clean up the hazards on his land and do what he can to have his neighbor do so. If not successful he should consult the Department of Forests and Waters.

Forest fire prevention is important. People must be educated to appreciate the woods and their value and the menace destructive fire is to them. When people interested in the forests preach forest fire prevention at all times and in all places—in the store, at home, on the street, in school and church—forest fires will become as rare in Pennsylvania as they are in some of the European countries. Prevent Forest Fires—It Pays.

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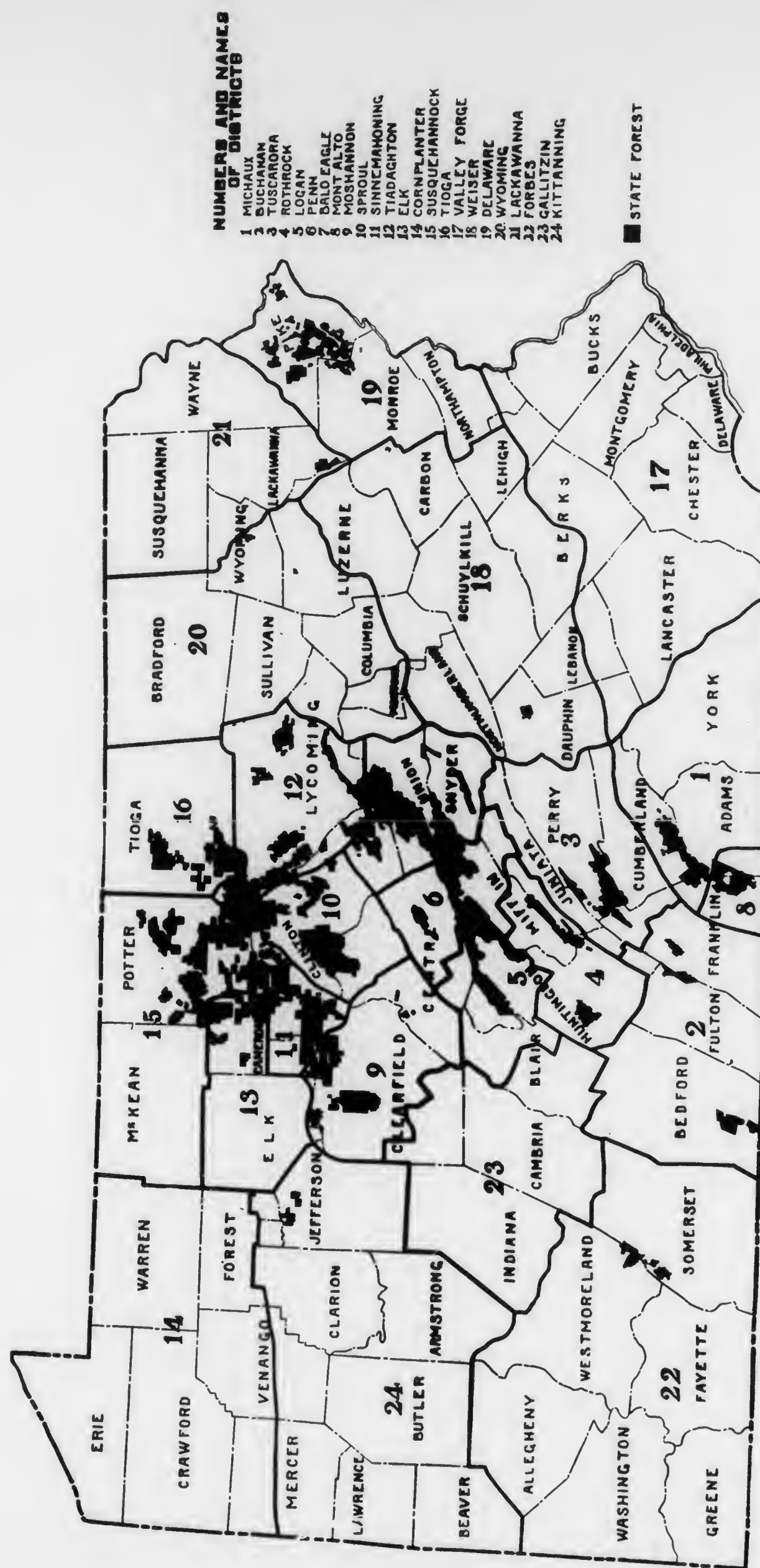


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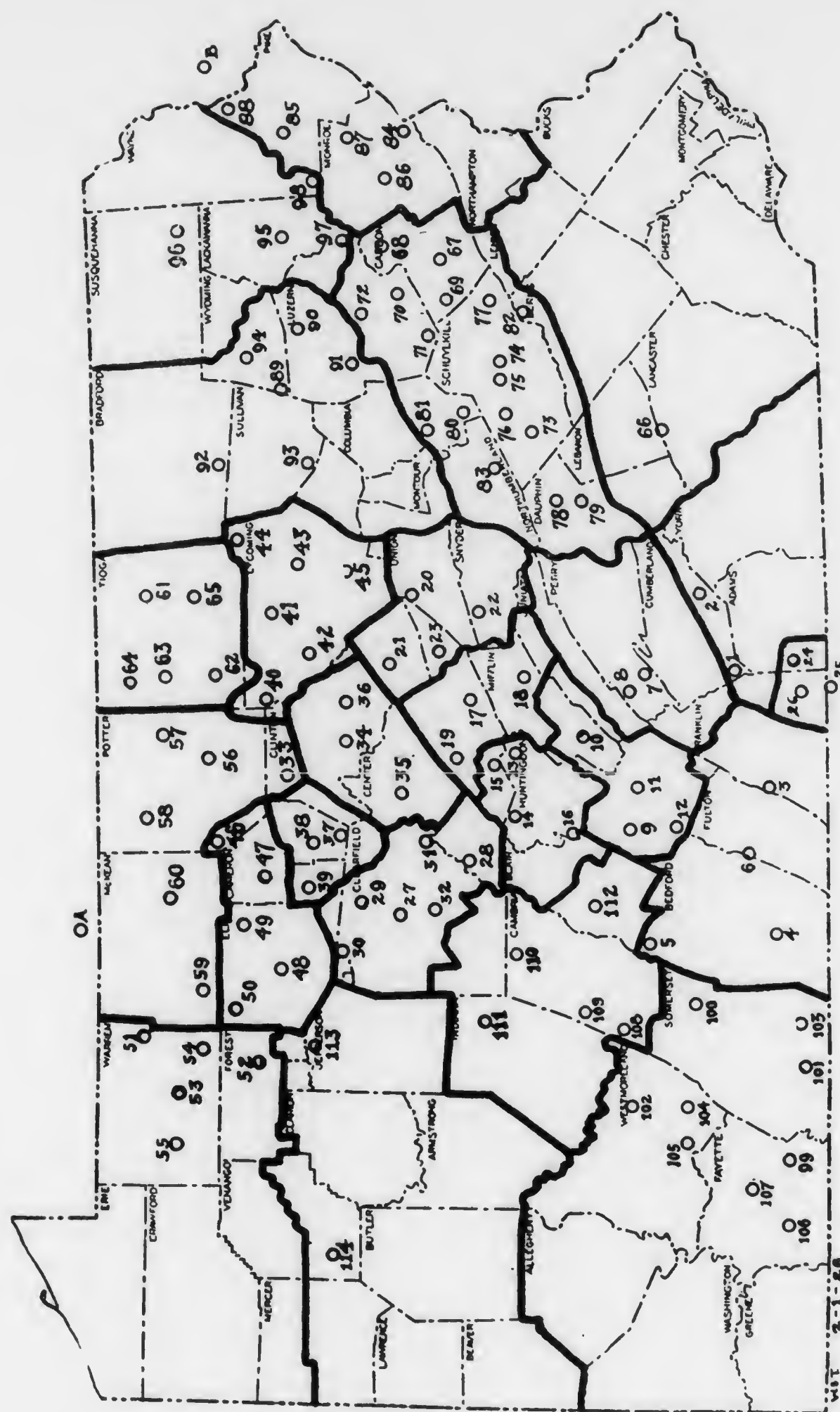
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WHERE THE 1,131,783 ACRES OF STATE FORESTS ARE LOCATED
(January 1, 1926)

FOREST DISTRICTS AND HEADQUARTERS OF DISTRICT FORESTERS

Forest District Number	Name of Forest District	Post Office
1	Michaux	Fayetteville, R. D. No. 2
2	Buchanan	McConnellsburg
3	Tuscarora	Blain
4	Rothrock	Mt. Union
5	Logan	Petersburg
6	Penn	Milroy
7	Bald Eagle	Mifflinburg
8	Mont Alto	Mont Alto
9	Moshannon	Clearfield
10	Sproul	Renovo
11	Sinnemahoning	Driftwood
12	Tiadaghton	Williamsport
13	Elk	Emporium
14	Cornplanter	Warren
15	Susquehannock	Coudersport
16	Tioga	Wellsboro
17	Valley Forge	Harrisburg
18	Weiser	Pottsville
19	Delaware	Stroudsburg
20	Wyoming	Dushore
21	Lackawanna	Scranton
22	Forbes	Ligonier
23	Gallitzin	Johnstown
24	Kittanning	Clarion



FOREST FIRE OBSERVATION STATIONS
(Indicated by the circles)

PENNSYLVANIA FOREST FIRE OBSERVATION STATIONS

Forest District	Tower	Elevation (feet)	County
1	MICHAUX		
	1. Big Flat	2,080	Cumberland
	2. Long Mountain	1,570	Cumberland
2	BUCHANAN		
	3. Tuscarora	2,440	Franklin
	4. Martin Hill	3,075	Bedford
	5. Blue Knob	3,165	Bedford
	6. Sideling Hill	2,350	Fulton
3	TUSCARORA		
	7. Shermans Mountain	2,100	Perry
	8. Big Knob	2,200	Perry
4	ROTHROCK		
	9. Round Mountain	2,080	Huntingdon
	10. Blue Mountain	2,000	Mifflin
	11. Jacks Mountain	2,360	Huntingdon
	12. Robertsdale ¹ (Wooden)	2,120	Huntingdon
5	LOGAN		
	13. Greenwood	2,300	Huntingdon
	14. Bald Knob	1,700	Huntingdon
	15. Little Flat	2,400	Centre
	16. Loop	2,360	Blair
6	PENN		
	17. Poe Mountain	2,140	Centre
	18. Wagner	2,200	Juniata
	19. Purdue	1,840	Centre
7	BALD EAGLE		
	20. Sand Mountain	2,070	Union
	21. Riansares	2,293	Clinton
	22. Middleswarth	2,127	Snyder
	23. Round Top (Wooden)	2,208	Centre
8	MONT ALTO		
	24. Staley's Knob	1,880	Adams
	25. Quirauk ²	2,145	State of Maryland
	26. White Rock ³ (Wooden)	1,550	Franklin
9	MOSHANNON		
	27. Smith Place	2,300	Clearfield

¹ Owned by Rock Hill Coal & Iron Co.

² Owned by Western Maryland R. R. Co. Manned in cooperation with State of Maryland.

³ Top not inclosed.

<i>Forest District</i>	<i>Tower</i>	<i>Elevation (feet)</i>	<i>County</i>
9	MOSHANNON—(Concluded)		
	28. Summit	2,300	Centre
	29. Knobs	2,200	Clearfield
	30. Boone Mountain	1,900	Elk
	31. Grass Flat	1,662	Clearfield
	32. Faunce	1,713	Clearfield
10	SPOUL		
	33. Tamarack	2,200	Clinton
	34. Coffin Rock	2,325	Clinton
	35. Snow Shoe	2,000	Centre
	36. Whetham	2,300	Clinton
11	SINNEMAHOING		
	37. Three Runs	2,160	Cameron
	38. Grove Mountain	2,100	Cameron
	39. Winslow		Elk
12	TIADAGHTON		
	40. Pump Station	2,150	Lycoming
	41. Buck Horn	2,000	Lycoming
	42. Huntley ³	2,000	Lycoming
	43. Long Ridge	2,000	Lycoming
	44. Holmeshurst	2,000	Lycoming
	45. Shaffers Path	1,500	Lycoming
13	ELK		
	46. Fox Mountain	2,400	Potter
	47. Whittimore	2,000	Cameron
	48. Bootjack	2,150	Elk
	49. Wildwood	2,340	Elk
	50. Hanley	1,998	Elk
14	CORNPLANTER		
	51. Coal Knob ⁴	2,154	Warren
	52. Eldridge Summit	1,860	Forest
	53. Wheeler	1,950	Warren
	54. Sheffield	2,000	Warren
	55. Cole Hill	1,950	Warren
15	SUSQUEHANNOCK		
	56. Cherry Springs	2,499	Potter
	57. West Pike	2,441	Potter
	58. Crandall Hill	2,170	Potter
	59. McDade	2,250	McKean
	60. Prospect	2,500	McKean

³ Top not inclosed.⁴ Built and owned by U. S. Forest Service.

<i>Forest District</i>	<i>Tower</i>	<i>Elevation (feet)</i>	<i>County</i>
16	TIOGA		
	61. Rarick	2,284	Tioga
	62. Gleason ³	2,130	Tioga
	63. Goodall	2,300	Tioga
	64. Baldwin	2,334	Tioga
	65. Maple Hill	2,085	Tioga
17	VALLEY FORGE		
	66. Cornwall	1,200	Lancaster
18	WEISER		
	67. Mauch Chunk	1,685	Carbon
	68. Stony Point	2,000	Carbon
	69. Broad Mountain ⁵	1,820	Carbon
	70. Freeland Platform ^{5,6}	2,000	Luzerne
	71. Humbolt	1,980	Luzerne
	72. Penobscot	2,140	Luzerne
	73. Keffers (Good Spring)	1,620	Schuylkill
	74. Brockton ^{5,6}	1,400	Schuylkill
	75. Silver Creek	1,748	Schuylkill
	76. Mt. Pleasant	1,782	Schuylkill
	77. Bulls Head ⁵	1,674	Schuylkill
	78. Lykens	1,630	Dauphin
	79. Stony Mountain	1,660	Dauphin
	80. Aristes ^{3,5}	1,700	Columbia
	81. Catawissa	1,825	Columbia
	82. Port Clinton	1,630	Berks
	83. Boyer's Knob	1,805	Northumberland
19	DELAWARE		
	84. Delaware Water Gap	1,600	Monroe
	85. Big Pocono	2,367	Monroe
	86. High Knob	2,010	Pike
	87. Snow Hill	1,400	Monroe
	88. Westfall	1,440	Pike
20	WYOMING		
	89. Ricketts	2,520	Wyoming
	90. Harvey's	1,700	Luzerne
	91. Shickshinny	1,520	Luzerne
	92. Kahill	2,200	Bradford
	93. North Mountain	2,500	Sullivan
	94. Mehoopany	2,320	Wyoming

³ Top not inclosed.⁵ Anthracite Forest Protective Association towers.⁶ Top partially inclosed.

Forest Tower District		32 Elevation (feet)	County
21	LACKAWANNA		
	95. Scrub Oak	2,092	Lackawanna
	96. Elk Hill	2,634	Susquehanna
	97. Dry Land Hill	1,900	Luzerne
	98. Goulds	2,386	Wayne
22	FORBES		
	99. Sugar Loaf	2,900	Fayette
	100. Statler Hill	2,705	Somerset
	101. Negro Mountain	3,190	Somerset
	102. Bear Cave	2,630	Westmoreland
	103. Hay's Mill	2,940	Somerset
	104. Morris Point	1,970	Westmoreland
	105. Kecksburg	1,570	Westmoreland
	106. Goodwin Knob ⁷	1,190	Fayette
	107. Work Hill ⁷	1,470	Fayette
23	GALLITZIN		
	108. Lower Yoder	2,720	Cambria
	109. Chickaree	2,460	Cambria
	110. St. Lawrence	2,180	Cambria
	111. Glen Campbell	1,960	Indiana
	112. Brush Mountain	2,530	Blair
24	KITTANNING		
	113. Hay's Lot	2,011	Jefferson
	114. Victory	1,600	Venango

A-B Towers in New York

⁷ Bare knobs.

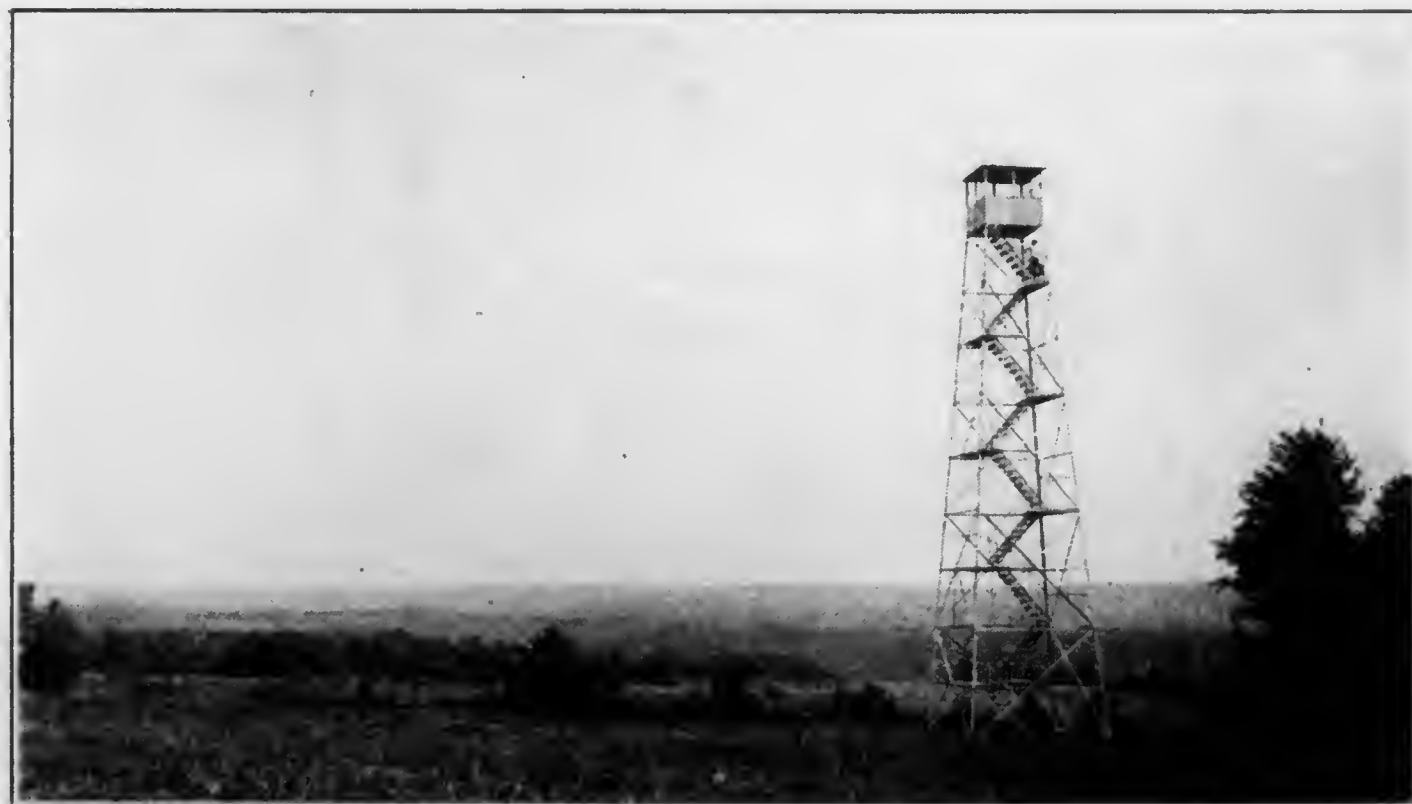


Photo by A. B. Deane
FOREST FIRE OBSERVATION TOWER

FOREST CONVERSION EXPERIMENT ON SCRUB OAK BARRENS

OF

SOUTHERN PENNSYLVANIA

BY

WILLIAM L. BYERS, District Forester
BUCHANAN FOREST DISTRICT

BULLETIN 41

(Special Studies Series)

PENNSYLVANIA DEPARTMENT OF FORESTS AND WATERS
ROBERT Y. STUART, Secretary
HARRISBURG, PA.

1926

<i>Forest District</i>	<i>Tower</i>	<i>32 Elevation (feet)</i>	<i>County</i>
21	LACKAWANNA		
	95. Scrub Oak	2,092	Lackawanna
	96. Elk Hill	2,634	Susquehanna
	97. Dry Land Hill	1,900	Luzerne
	98. Goulds	2,386	Wayne
22	FORBES		
	99. Sugar Loaf	2,900	Fayette
	100. Statler Hill	2,705	Somerset
	101. Negro Mountain	3,190	Somerset
	102. Bear Cave	2,630	Westmoreland
	103. Hay's Mill	2,940	Somerset
	104. Morris Point	1,970	Westmoreland
	105. Kecksburg	1,570	Westmoreland
	106. Goodwin Knob ⁷	1,190	Fayette
	107. Work Hill ⁷	1,470	Fayette
23	GALLITZIN		
	108. Lower Yoder	2,720	Cambria
	109. Chickaree	2,460	Cambria
	110. St. Lawrence	2,180	Cambria
	111. Glen Campbell	1,960	Indiana
	112. Brush Mountain	2,530	Blair
24	KITTANNING		
	113. Hay's Lot	2,011	Jefferson
	114. Victory	1,600	Venango

A-B Towers in New York

⁷ Bare knobs.



Photo by A. B. Deane
FOREST FIRE OBSERVATION TOWER

FOREST CONVERSION EXPERIMENT ON SCRUB OAK BARRENS

OF

SOUTHERN PENNSYLVANIA

BY

WILLIAM L. BYERS, District Forester
BUCHANAN FOREST DISTRICT

BULLETIN 41

(Special Studies Series)

PENNSYLVANIA DEPARTMENT OF FORESTS AND WATERS
ROBERT Y. STUART, Secretary
HARRISBURG, PA.

1926

INTENTIONAL SECOND EXPOSURE

NAMES OF FOREST DISTRICTS AND DISTRICT FORESTERS
OF PENNSYLVANIA AND THEIR ADDRESSES

<i>Forest District</i>	<i>District Forester</i>	<i>Headquarters and Address</i>
Michaux	John R. Williams	Caledonia Park, Fayetteville, R. D. No. 2, Pa.
Buchanan	W. L. Byers	McConnellsburg, Fulton County, Pa.
Tuscarora	B. D. McPherson	Blain, Perry County, Pa.
Rothrock	Walter Leach	Crum Building, Mount Union, Pa.
Logan	T. Roy Morton	2 King St., Petersburg, Pa.
Penn	Thos. C. Harbeson ...	Milroy Bank Building, Milroy, Pa.
Bald Eagle	Raymond B. Winter ..	Borough Building, Mifflinburg, Pa.
Mont Alto	Edwin A. Ziegler	State Forest School, Mont Alto, Pa.
Moshannon	William F. Dague	County National Bank Bldg., Clearfield, Pa.
Sproul	Forrest H. Dutlinger .	118 Sixth Street, Renovo, Pa.
Sinnemahoning ...	C. C. Hogeland	Driftwood, Pa.
Tiadaghton	Homer S. Metzger ...	Irwin Building, Williamsport, Pa.
Elk	Charles E. Baer	Fourth St. east of Broad, Emporium, Pa.
Cornplanter	H. B. Rowland	Bell Oil and Gas Bldg., Warren, Pa.
Susquehannock ..	H. E. Elliott	Cor. 2d and East Sts. Coudersport, Pa.
Tioga	P. H. Mulford	Old First National Bank Building, Wellsboro, Pa.
Valley Forge ...	George H. Wirt	Dept. Forests and Waters, Harrisburg, Pa.
Weiser	H. A. Smith	6 North Centre St., Pottsville, Pa.
Delaware	R. W. Stadden	618 Main St., Stroudsburg, Pa.
Wyoming	E. F. Brouse	Cor. Railroad & Market Sts., Dushore, Pa.
Lackawanna	R. Lynn Emerick	316 Washington Avenue, Scranton, Pa.
Forbes	V. M. Bearer	Bossart Building, Ligonier, Pa.
Gallitzin	T. I. Shirey	Swank Building, Johnstown, Pa.
Kittanning	C. E. Zerby	Cor. Main St. and 6th Ave., Clarion, Pa.

FOREST CONVERSION EXPERIMENT ON SCRUB OAK BARRENS OF SOUTHERN PENNSYLVANIA*

In the mountains of southern Pennsylvania are extensive areas of forest land called "Scrub Oak Barrens."

One of the first big problems that confronted me when I took charge of the Bedford State Forest in south-central Pennsylvania in 1907 was how to handle areas of forest land stocked chiefly with almost impenetrable thickets of aggressive Scrub Oak. After five years of field observation I concluded it would be worth while to start an experiment to find some practical method for replacing this Scrub Oak with valuable forest trees. Nature was working slowly along this line on areas upon which forest fires had been kept out, for here and there was evidence of the Scrub Oak giving way to better Oaks, pines, and other valuable forest trees. But the change appeared to be progressing so slowly that I became interested in a forest conversion experiment that aimed to replace the Scrub Oak by the planting of valuable forest trees.

Two big questions suggested themselves in this experiment: (1) Is it silviculturally possible to bring about this change?; and, (2) Can it be done at a reasonable cost?

After a general survey of the situation a typical Scrub Oak area was selected for this experiment on the Bedford State Forest. Two plots of one acre each were laid off in the fall of 1912. Plot A lies on the north side of the Blankly road, and Plot B borders it on the south. The area included in these plots was burned over by a forest fire in the spring of 1910. At the time the experiment was started, both plots were covered with a dense growth of scrub oak from 4 to 6 feet high. Among the Scrub Oak were scattered rock oak and chestnut sprouts from 6 to 8 feet high.

The second step in the experiment was the removal of all the existing growth on these two one-acre plots. This was done during the winter of 1912. All the growth was cut, piled, and burned at a cost of \$11.25 per acre (labor at 25 cents per hour). In the spring of 1913, 2,100 3-year old white pine seedlings on Plot A, and 2,400 3-year old white pine seedlings were planted on Plot B. The total cost of seedlings, transportation, and planting amounted to \$16.67 per acre. Growth records show that there was an establishment of 85% of the planted trees.

By the end of the growing season of 1913 the scrub oak sprout growth had again taken full occupancy of the two plots. An examination of the planted trees showed that their height growth was being retarded by the dense overgrowth of scrub oak. During the next few years it became evident that not more than 20% of the planted trees were making a fair height growth, and practically all of these stood in openings. The condition of the trees indicated that most of

*Read before the Allegheny Section, Society of American Foresters, at Harrisburg, Pa., on March 6, 1925.

them would die unless liberated. What they needed was more light and more growing space.

Accordingly, in the fall of 1919 it was decided to make a liberation cutting. In developing this phase of the experiment Plot B was retained as a check plot. It has received no treatment other than that given before planting in the spring of 1913. Plot A was divided into four equal plots of $\frac{1}{4}$ acre each. Each of the four plots was given a special designation and a specific kind of liberation treatment. Their designation and a description of their treatment follows:

Plot A-1. All the natural growth, consisting chiefly of scrub oak and other hardwood sprouts, was cut and removed from the area at a cost of \$3.50.

Plot A-2. All the natural growth with the exception of some of the most promising specimens of oak and chestnut, were cut and removed from the area at a cost of \$3.67.

A-3. The tops of all the natural growth were lopped. The lopped portion was allowed to remain on the area. After this treatment about one-half of the direct sunlight reached the seedlings. This work cost \$1.50.

A-4. The natural growth was cut back so that only a stub ranging from knee-high to thigh-high remained standing. The cut off material was allowed to remain on the same area. Under this treatment the trees received almost full sunlight. The cost of this work was \$1.50.

Growth data collected on these plots during January, 1926, gave the following results:

<i>Plot</i>	<i>Average Height* of Planted Trees</i>	<i>Percentage of Planted Trees Remaining on Plots (estimated)</i>
A-1	3.6	65
A-2	2.6	60
A-3	2.5	50
A-4	2.5	50
B-Check	3.0	20

From the growth measurements taken on these plots and from my field observation now covering almost 19 years, I submit the following conclusions:

1. No more than 15 per cent of 3-year white pine seedlings planted on scrub oak barrens will fight their way through if not given any liberation treatment after planting. The check area already shows a mortality of 80 per cent. The planted trees remaining on the check area average almost as high as on the other plots, only because the trees standing in openings remain. Most of the suppressed trees have died.

*Measurements on Plots A-1, A-2, A-3, and A-4 based on 50 trees each, and on Plot B based on 100 trees.

2. At least 70 per cent of the planted trees now present on Plots A-1 and A-2 will come through the scrub oak without further liberation cutting, while not more than 50 per cent of the trees now on Plots A-3 and A-4 will survive unless additional liberation work is done.
3. When forest land is first cleared of all the scrub oak growth and then planted with 3-year old seedlings, two liberation cuttings are recommendable in order to get through a sufficient number of trees to make a full stand. The first cutting should be made at 3 to 6 years, and the second at 7 to 9 years after planting.
4. The sprout growth from clear-cut scrub oak stumps will reach a height of 3 to 6 feet in three growing seasons.
5. By using 2-2 white pine transplants it may be possible to get the trees through with only one liberation cutting.
6. In making liberation cuttings the best results are obtained by cutting clear and remove all growth from the area. The planted trees on the clear-cut plots average one foot taller than on the top lopped and other plots upon which the growth was only partially removed.
7. The height growth differs little on the plots upon which the natural growth was top-lopped or cut from knee-high to thigh-high.
8. The establishment and growth of the planted trees is better on intensely burned spots than on unburned areas. Three planted trees standing on a plot within Plot A, upon which brush had been piled and burned, average (January, 1926) 10.1 feet in height, while nearby trees on unburned areas of the same plot, average only 3.6 feet. The burning was so severe under these brush piles that all the sprouts, stumps, and roots were killed off. This eliminated not only sprout, but also root competition. In addition, the ashes helped stimulate the height growth.
9. It is obvious from this experiment that white pine is not the right tree to use in forest conversion work on scrub oak barrens. These areas offer nothing above site-quality III for white pine. Upon such unfavorable sites it at best grows too slowly to compete with the aggressive hardwood sprout growth.
10. Pitch pine, Scotch pine, and Jack pine (*P. Banksiana*) are better species for using in forest conversion work on sites occupied by scrub oak thickets. The jack pine makes the most rapid height growth, but because of its thin foliage does not shade out the scrub oak rapidly after it does get above it. All evidence now available points to the pitch pine as the best tree to replace the scrub oak on the barrens of Pennsylvania.
11. The high cost of forest conversion work limits its extensive use. However, it may be good business to introduce valuable forest trees on selected areas. In time the seeds developed by these valuable trees may be a big factor in bringing in superior trees over large areas now occupied by inferior trees.

*"Let us develop the resources of our land,
Call forth its powers,
Promote all its great interests,
To see whether we also
In our day and generation,
May not perform something to be remembered."*

--Daniel Webster

Prevent Forest Fires
IT PAYS

*The forest is a heritage given to us by Nature,
not to spoil nor devastate, but to be wisely
used, reverently honored, and carefully main-
tained. :-: :-: :-:*

*The preservation of our forest is an impera-
tive business necessity. We have come to see
clearly that whatever destroys the forest, ex-
cept to make way for agriculture, threatens
our well-being.*

Everybody Loses
When Timber Burns

If the Nation Saves the Trees
The Trees will Save the Nation

s.d.
634.9
Pe. 415 hr
no. 42

MAKING FARM WOODLANDS PAY

s.d.
634.9
Pe. 415 hr
no. 42

BLEED THROUGH

MAKING FARM WOODLANDS PAY

By JOHN W. KELLER
Chief, Bureau of Extension



Bulletin 42

Commonwealth of Pennsylvania
DEPARTMENT OF FORESTS AND WATERS
Robert Y. Stuart, *Secretary*
Harrisburg
1926

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MAKING FARM WOODLANDS PAY

THE SITUATION

Farm woodlands in Pennsylvania occupy an area of 4,000,000 acres. This is more than one-eighth of the land area of the State and includes the best land that is used for timber production. These woodlands have produced some of the best and most valuable timber grown in this Commonwealth but because of the lack of care many acres are now almost depleted of valuable tree growth. In fact, some tracts are actually liabilities to the owner. When we recall the many farm mortgages that have been lifted, the children that have been educated and the numerous bank accounts that have been enlarged by the sale of products from farm woodlands, it must be admitted that these lands are not receiving the attention and care they rightfully deserve.

It is the exception to find an ideal tract of farm woodland in Pennsylvania. The present condition is largely the result of careless lumbering and grazing. Fires have not been so destructive on farm woodlands as on our mountain timberlands. This is not always the result of protection given by the owner but is to be expected since these tracts are isolated from large areas of timber. The lack of care that should have been given the young trees during cutting operations and the grazing of cattle, sheep and hogs have prevented young trees from taking the place of those that were removed. Only one result could be expected and we have it in the run down condition so often found on the farm woodlands throughout the state.

Frequently it is thought that woodlands need no care or attention because natural growing trees will soon come up to replace those that are removed. This is not always true. Nature has been very kind in restoring tree growth on denuded lands but too often these trees are not the most valuable that will thrive on the tract and they are not properly spaced for the highest timber yield. A similar condition is seen in the volunteer crop that comes up after the wheat harvest, but no farmer would think of protecting and harvesting this second crop. The farmer has learned that he must plant and care for his wheat in order to secure a satisfactory yield. The same principle applies with the timber crop. No timberland owner should be satisfied with a few scattered trees per acre when, with a little attention and care he may have a full stand and a much higher yield.

It is true that woodlands require less care than any other crop but the best results may be expected only when the right kinds of

trees are started, evenly spaced and properly cared for until they grow large enough for the market. Fortunately it is not always necessary to plant trees after lumbering. As a rule a good stand of young timber trees will come in naturally if proper care is given the small trees during the cutting and logging operations. Since the farmer usually cuts a limited number of trees each winter when other farm work is not pressing he is in a position to give this care with little extra work. With proper attention any woodlot may be made productive.

Can Pennsylvania Farmers afford to neglect their timberlands?

NEED FOR FARM WOODLANDS

The farmers of Pennsylvania use \$35,000,000 worth of wood annually. They utilize one-third of the saw timber that is consumed in the State. Without wood agriculture could not be carried on. If it is poor management for a farmer to purchase feed for his stock when he can grow it himself, it is equally poor management for him to pay \$35.00 to \$125.00 per thousand for lumber he should be growing on his woodlands or on idle acres of the farm.

Farm woodlands of Pennsylvania are capable of producing \$40,000,000 worth of wood each year. They are now furnishing only \$12,000,000 worth annually. The farmer should have this difference which amounts to \$138.00 annually for each of the 202,000 farms in the State. No farmer can be prosperous when the taxes and upkeep on his unproductive lands eat up the profits he makes from his best fields. Farm woodlands should not only supply all the wood needs on the farm but if properly managed they will furnish wood for sale.

Farmers do not boast that they can get along without producing on their farms such indispensable products as will be supplied from farm woodlands.

CARE OF THE WOODLOT

FIRE is always harmful to timberlands. Even light burnings kill small trees and scar large ones. They destroy humus and forest litter which provide a natural seedbed, a soil that absorbs rainfall readily, and a cover that conserves it.

The greatest care should be taken by each person frequenting woodlands so that no fires are started. Cardboard signs for posting on woodlands, calling attention to the need for being careful with fires, will be supplied free of charge on request to the Department of Forests and Waters.

Fires are the curse of the Forests.

PASTURING will eventually destroy woodlands. Cattle, sheep, horses and hogs will eat, break and root up small trees. Many of the dead tops on older trees are the direct result of live stock packing the soil beneath the trees and exposing and barking the roots. The ill effects of pasturing are not noticed immediately. It takes years under some conditions before they become apparent. Nevertheless they are bound to come and the only way to prevent loss is to prohibit pasturing of all kinds. If a farmer must have shade for his livestock, a small part of the woodlot should be fenced off for the purpose. The best results cannot be had when the same area is used for pasture and the growing of trees.

The Pennsylvania Department of Agriculture has compiled figures showing that over 1,397,000 acres of farm woodlands are pastured.

GRASS in a woodlot indicates that the trees are not growing close enough to completely cover the ground. When the tops of the trees touch each other as they do in a well regulated woodlot the sun cannot reach the ground and grass will not grow.

The largest timber crop can be grown only when all the land is fully occupied. The number of trees per acre that are required to make up a full stand varies with the kind and size of the trees and the condition of the soil.

THINNINGS are necessary to permit the fastest growth. From 1,500 to 3,000 small trees should be growing on an acre. As they grow larger they will crowd each other and the more thrifty ones will overtop the others. This fight for space and light is beneficial when the trees are young since it causes rapid height growth and prevents the development of large side limbs. However, when the trees are from 25 to 35 feet high this condition will not permit the most rapid wood production. At this time it will be necessary to make a thinning by removing the less valuable and less thrifty trees. This will stimulate growth of the trees that remain by giving each tree sufficient light and space to develop. The trees that are least valuable for timber, should be marked and removed. Neither the number of trees per acre nor the spacing of the trunks in the stand are of themselves guides to the proper amount of thinning to be done. Each tree has its own form and height requirements and a successful thinning leaves enough trees to fully shade the ground. No openings should be made between the tree tops that will not grow together in several years. When it is necessary to thin a dense stand it should be done with great care, especially with shallow rooted trees such as white pine and hemlock. This is to prevent windfall among the trees that remain. It can best be done by cutting out a few trees at a time so that the remaining trees will develop bracing roots. The trees growing along

the edge of the woodlot should have branches to the ground to assist in preventing windfall.

Thinning dense stands that are more than 25 feet in height will increase wood production.

TRIMMING the lower limbs is not necessary in the woodlot. When trees are growing close together the lower limbs are shaded and eventually will die. These dead limbs usually break off leaving a trunk free from limbs.

Trimming trees in a woodlot adds to the appearance but does not increase wood production.

DYING AND SUPPRESSED trees that are large enough to be utilized should be removed. Unsound, crooked and broken trees will become less valuable each year. They should be cut and utilized. If these trees are left in the woods they become a fire menace and a breeding place for destructive insects and fungi. They are worse than worthless. Healthy trees usually do not suffer from common tree pests. All blighted chestnut trees should be cut.

There is no practical method to save a chestnut tree that has been attacked by the blight.

MATURE TREES and those that have made their most rapid growth should be utilized. It is satisfactory to wait a few years for favorable market conditions but it should be remembered that over-mature trees deteriorate rapidly after they start to decline.

Forestry provides for "utilization by wise use" and under no circumstances should merchantable trees be permitted to rot in the woods.

GRAPE, IVY AND BITTER SWEET VINES may kill trees on which they grow. They should be cut off at the ground. The tree tops and limbs may be broken if an attempt is made to remove the vines. For this reason they should be left on the trees.

Dead vines will do no harm.

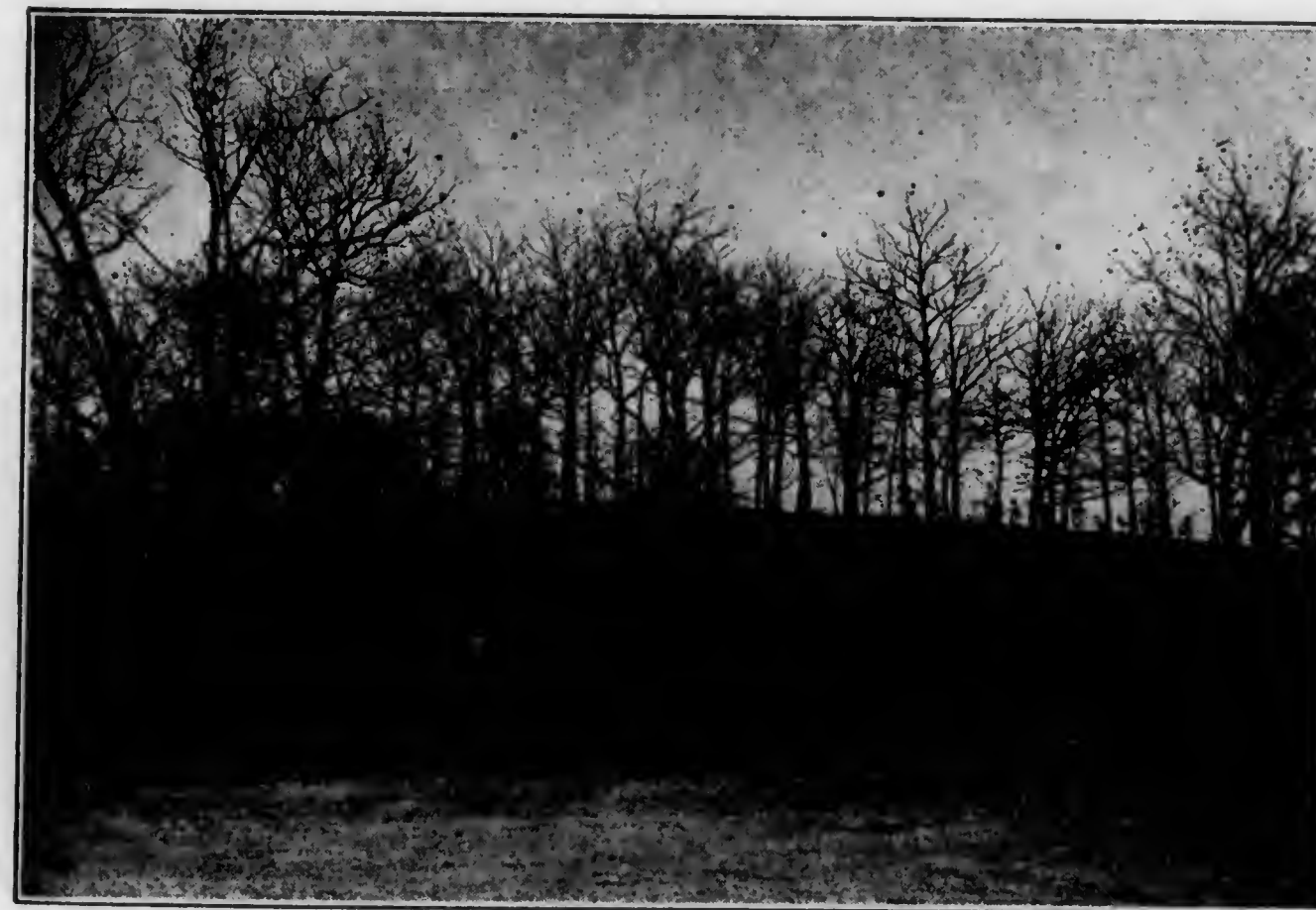
FUNGI weaken and kill trees and cause decay after the trees are cut. They usually enter living trees through wounds of where the bark is broken.

To prevent loss from this source no unnecessary cutting or barking of trees should be permitted.

INSECTS will tunnel under the bark and bore in the trunk of living trees, or into newly made logs. In the forest the spread of insects may be checked by cutting trees that are attacked when the insects are in the egg, larva, or pupa stage. This work must be



TREES CANNOT THRIVE WHERE PASTURING IS PERMITTED



AN OPEN WOODLOT HAS NO FUTURE BECAUSE THERE ARE NO YOUNG TREES TO REPLACE THOSE THAT ARE REMOVED

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THINNING DENSE STANDS WILL INCREASE WOOD PRODUCTION



GRAPE, IVY AND BITTERSWEET VINES MAY KILL TREES ON WHICH THEY GROW

done at the proper time. Information will be given gladly upon request to the Department of Forests and Waters. Infested trees should be burned or removed from the forest and utilized at once. Weak trees are most frequently attacked by insects and fungi. The woodlot should be kept free of sickly or dying trees to assist in preventing these attacks. Logs, cordwood, ties and other wood products should be removed from the woodlot before fungi or insects begin to work in them.

It is very important that all trees retained in the woodlot are sound and healthy.

When trees in the woodlot are suffering from pests of any kind, specimens of the pests and the affected parts of the tree should be forwarded to the Department of Forests and Waters, Harrisburg, for identification and suggested remedial measures.

FOREST WEED TREES such as witch hazel, dogwood, water beech, laurel, June berry, fire cherry, aspen, etc., need not be cut unless they are interfering with or overtopping more valuable trees.

These trees help to protect the soil and conserve the moisture.

OPEN AREAS in the woodlot should be closed by planting if there are no natural growing seedlings on the ground. A very careful examination should be made before any trees are planted in the woodlot. If nature will restore valuable trees it is not necessary for the land owner to go to the trouble and expense of planting them.

Trees for planting will be supplied by the Department of Forests and Waters at the cost of boxing and packing.

THE TIME REQUIRED to produce the original stands of virgin timber unaided by man was frequently centuries. A little attention given farm woodlands each year will permit the growing of equally good wood products in 40 to 100 years.

Give the woodlands a chance and the rapid growth the trees will make will be an agreeable surprise.

TIMBER CUTTING RECOMMENDATIONS

Most of the virgin timber in Pennsylvania was cut without thought of another crop of trees. The result is that there are vast areas of idle forest land in the State. The scarcity of home grown lumber and the increasing prices that must be paid for imported wood products impress the need for preventing waste and conserving young growth during cutting operations. The following recommendations should be followed in all lumber operations so that the tract upon



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LOPPED AND SCATTERED BRUSH ROTS QUICKLY, IMPROVES THE SOIL,
AND AVOIDS FIRE HAZARD



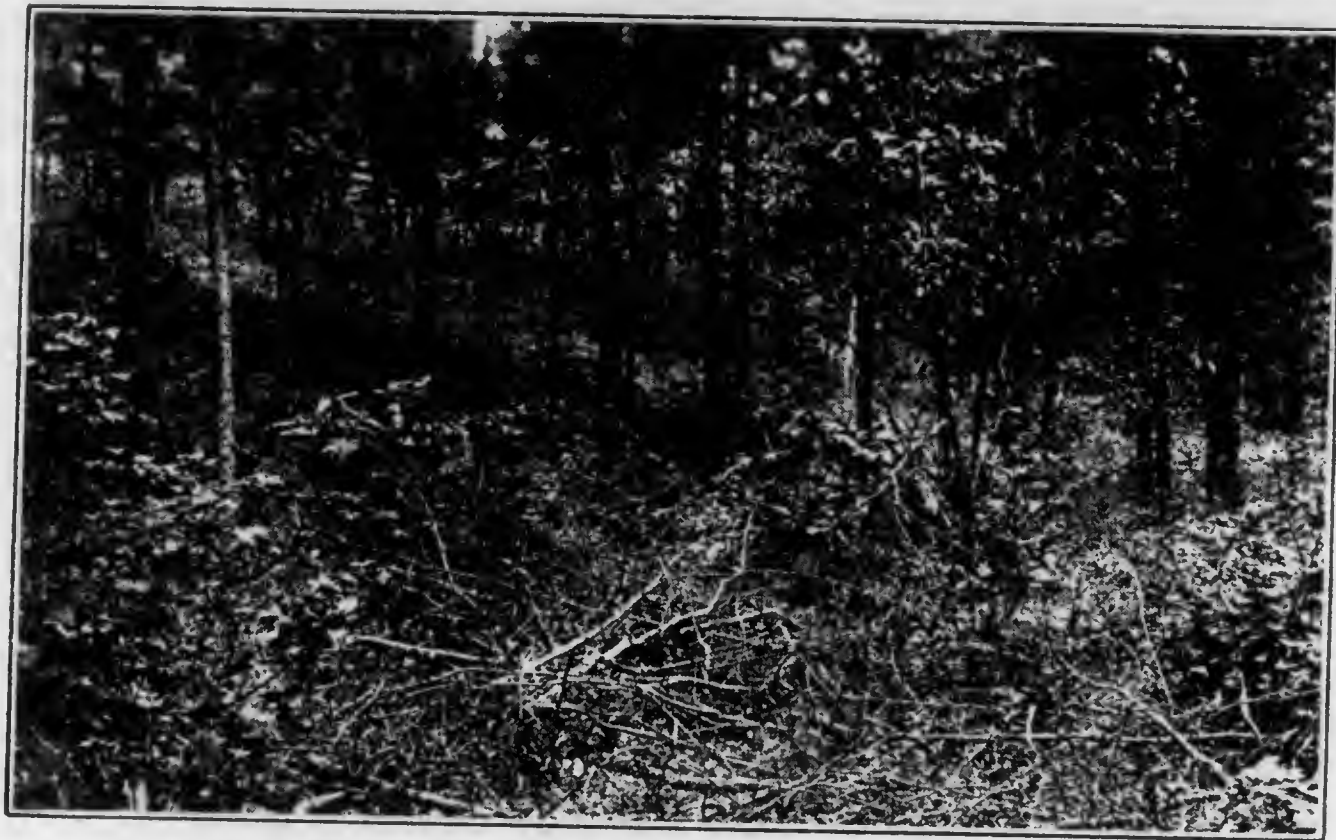
CUT STUMPS LOW—NOT HIGHER THAN THE DIAMETER OF THE TREE
AT THE POINT OF CUTTING



WOODLOT IN NEED OF IMPROVEMENT CUTTING



IDLE ACRES ON THE FARM SHOULD BE PLANTED WITH TREES



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WOODLOT IN NEED OF IMPROVEMENT CUTTING



IDLE ACRES ON THE FARM SHOULD BE PLANTED WITH TREES

completion of the cutting will be in the best condition to grow another crop of trees.

First.—Mark or otherwise designate all trees that are to be removed. Permit no other trees to be cut.

Second.—Use the saw instead of the axe for cutting trees and limbs more than 4 inches in diameter. This will prevent waste.

Third.—Utilize sound dead trees and all tops and limbs to the smallest diameter that can be marketed. This is usually 3 inches.

Fourth.—Fell trees in open places and with the largest limbs up or down, so they will not sweep down the young growth.

Fifth.—Cut as little young growth as possible in making room for felling, lopping and skidding.

Sixth.—Cut stumps low—not higher than the diameter of the tree at the point of cutting.

Seventh.—Cut no sound trees less than 10 inches at breast height except for special uses, and then only under such provisions that will insure another crop of trees.

Eighth.—Burning of hardwood slash, or mixed evergreens and hardwoods, is not recommended. Lop the brush to a minimum diameter of 2 inches and scatter it so that it will lie close to the ground and rot quickly.

Ninth.—Fell all unmerchantable dead trees so they will rot quickly and reduce the fire hazard.

Tenth.—Cut hardwoods wherever possible after the leaves have fallen, so that the young growth remaining will be protected.

Eleventh.—Leave no trees lodged in the process of felling.

The foregoing recommendations if followed will assure timberland owners of getting the full amount of wood products from their trees, and by saving the valuable young growth during the lumber operation another crop of timber may be cut from the tract from 10 to 30 years sooner than if these small trees are carelessly injured or destroyed.

If Pennsylvania is to become self-supporting in lumber production she must prevent waste and protect small trees during lumber operations.

STUMPAGE SALES

If the timberland owner does not wish to have the trees cut under his supervision he may sell all of the merchantable trees and retain the land. This is called a stumpage sale. When it is used the land owner should enter into a contract with the purchaser so that the

tract will be protected from unnecessary carelessness during the lumbering operation. A suggested form of timber contract is given below.

This form includes the general considerations; additions may be made to conform to special conditions which are usually a part of each stumpage sale.

SUGGESTED TIMBER SALE CONTRACT

THIS AGREEMENT made this day of 19...., between of in the County of and State of Pennsylvania hereinafter called the Seller, party of the first part, and of State of hereinafter called the Purchaser, party of the second part.

WITNESSETH THAT the said Seller for and in consideration of premises hereof and the payments to be made by the Contractor agrees:

First: To allow the Purchaser right of access, ingress, egress, and regress to, on, over and through a tract of land belonging to the Seller, situated in Township, ... County, Pennsylvania..... containing acres more or less, and the right to cut and remove therefrom such timber as is included in the terms of this contract.

Second: To allow the said Purchaser to set up a saw mill at such place as shall be agreed upon by the parties hereto and clear sufficient space for this purpose.

And the said Purchaser, in consideration of the rights and privileges granted to him herein by the Seller agrees:

First: To cut only marked trees except By marked trees are understood only such as have a mark placed thereon adopted and made known by the Seller to the Purchaser before cutting begins.

Second: To avoid unnecessary injury to trees which are not marked for cutting, when felling, working up the trees, or hauling out any or all timber or wood,—by being careful to throw each tree so that it will not fall against, into, or upon trees which are not marked for cutting; to refrain from cutting saplings or poles except as specifically permitted by the Seller; to use existing roads, as far as practicable;

and in no case to haul across, trample or fell trees on growing crops except by the written consent of the Seller.

Third: To pay for each tree that is unnecessarily cut or wantonly injured in violation of the terms of this contract, such price as may be agreed upon by the parties hereto, at

Fourth: To lop from the tree tops and large limbs all branches down to a diameter of two (2) inches and leave all tree tops, branches, and brush scattered and lying close to the ground and thus in a position to rot rapidly.

Fifth: To leave all woods roads, at present on said tract, clear of tree tops, brush and other obstructions.

Sixth: To exercise reasonable precaution against the spread of fire in the woods, by maintaining an efficient spark arrester on any coal or wood burning engine and keeping the ground about such engine clear from inflammable material for a radius of feet, and to put his entire force at the mills or in the woods to fighting fires that may occur therein from any cause whatsoever.

Seventh: To complete operations under this contract on or before and to remove all mills and machinery from said tract within 60 days after such completion.

Eighth: To pay the Seller for the timber cut and removed as follows:

.....
.....
.....
.....
.....

It is mutually agreed: That in case of dispute between the parties of the first and second parts in reference to matters relating to the faithful performance of the provisions of this contract, such difference of opinion shall, subject to the terms and conditions hereof, be referred to arbitrators, one of whom shall be selected by the Seller and the other by the Purchaser, and in case the two arbitrators so selected shall disagree, they shall select a third arbitrator; and the decision of the majority of the arbitrators shall be final, with respect either to acts to be done or compensation to be paid by either party to the other.

WITNESS the hands and seals of the parties to this agreement the day and year first above written.

Witness:

(Signed) (Signed) (Seal)
(Signed) (Signed) (Seal)

SOME INTERESTING RECORDS OF PENNSYLVANIA TIMBERLANDS THAT HAVE PAID

Mr. J. M. Buzard, Stratonville, Clarion County, cut 65,000 board feet of white pine on a tract of 1½ acres in Heath Township, Jefferson County, on which 29 years before he had hoed potatoes. The timber was cut into dimension stuff ranging in size from 2" x 4" x 8' to 10" x 10" x 18' and found a ready market in Pittsburgh. This tract is fertile bottom land between two streams where an abundance of moisture permitted the trees to make their best growth. The stand resulted from wind-blown seed.

Mr. Henry Neeb, Weissport, Carbon County, bought a farm in 1898 which comprised about 100 acres of cleared land and 109 acres of woodlands. Careful records kept by the owner show that more than 250,000 board feet of white pine and hemlock lumber and 2,100 tons of mine props were removed from the area, for which Mr. Neeb received approximately \$8,700. This does not include chestnut poles, fence posts and firewood which were cut by neighbors on a 50-50 basis. Mr. Neeb carefully protected the young trees and favored the most valuable ones during cutting operations. When he sold his farm in 1924 the woodlot had upon it an average of 20 tons of mine props and 2,000 board feet of lumber per acre under which were growing the finest example of natural regeneration of white pine and hardwoods from 15 to 30 feet high to be found in the State of Pennsylvania, and yet during the last 24 years the area had yielded a profit of almost a dollar a day.

Mr. J. K. Morrison, Emporium, R. F. D., has a woodlot of 12 acres that was cut over 35 years ago. During the past year he cut 47,000 board feet of hemlock and 2,000 board feet of hardwoods for which he received \$40.00 per thousand at the mill. He expects to cut 150,000 board feet more from the area and will leave all trees under 6" in diameter at breast high for the next timber crop. Mr. Morrison has a portable sawmill and uses his tractor for power. He is sure of his winter's work but always finds time to do a little custom sawing for his neighbors.

Mrs. Helen Ragna, Honesdale, Wayne County, handicapped by her husband's ill health, donned working clothes and with her 17-year old stepson cut trees on their 6-acre woodlot and paid off a \$3,600.00 mortgage on her home. She demonstrated her ability, not only as a woodchopper, but also as a business woman because she decided to cut the timber herself when she was offered but \$1,600.00 for it. She knew it was worth more. The larger trees were cut into saw logs, the tops

and large limbs were used for mine props, ties and lagging, and no careless or wasteful methods were permitted. The work was done during the past two winters after the leaves had fallen so that the young growth would be protected. Mrs. Ragna has gained the title, "The Woman Wood Chopper of Wayne County."

Mr. I. E. Veley, Coudersport, Potter County, cut over a 90-acre tract of beech and maple 18 years ago. It also contained scattered hemlock trees that were carefully protected during the cutting. With an eye on the next timber crop, Mr. Veley cut no trees smaller than 8" at the top of the first log and carefully protected all the young growth. A sample acre of the tract shows that there are now 40 trees from 8 to 15 inches in diameter, 50 trees from 4 to 8 inches in diameter and an excellent stand of young maple and beech 2½" in diameter and 30 feet high. Mr. Veley now has an excellent sugar bush of trees 10" in diameter and over. In 10 years he can cut 35,000 feet of hemlock from his tract, and in 20 years he should have a mature stand of chemical wood for the market.

Hon. C. M. Bower of Blain, Perry County, cut 300,000 board feet of second growth lumber from an 80-acre woodlot in 1903-1904 and 397,000 board feet from the same tract in 1923-1924. He was careful that the young trees were not injured during the lumber operations and the more valuable kinds of trees were favored for the next timber crop. The timber consisted of oak, pine, walnut and poplar. More than 100,000 board feet of merchantable timber was left after each cutting.

Reynolds Bros., Reynoldsville, Jefferson County, clear cut a 40-acre woodlot 32 years ago. The cutting was followed by a fire. Trembling and large tooth aspen grew up abundantly among the more valuable hardwoods. They have just cut 150 cords of aspen pulp wood having a 2" minimum diameter for which they received \$9.00 per cord on the car. There remains a good stand of beech, birch and maple 4-6 inches in diameter and 45-50 feet high.

Mr. John Molyneux, Forksville, R. D., Sullivan County, cut over his 50-acre woodlot during the winter of 1923-1924. Sound trees less than 12 inches in diameter were not cut. A total of 260,000 board feet of maple, beech, birch, basswood and ash were cut for which the owner realized a net profit of over \$4,200. There remains on the area approximately 3,500 board feet per acre of hemlock, beech, birch and maple. These trees should grow more rapidly since the cutting was made.

Mr. C. H. Warren, Wellsboro, R. D. No. 5, Tioga County, cut the timber from his 12-acre woodlot, which yielded 12,250 board feet per acre of maple, beech, ash and basswood. The material sold amounted

INDIANA STATE LIBRARY



TREES THRIVE WHERE AGRICULTURAL CROPS CANNOT GROW



PREVENT EROSION ON STEEP HILLSIDES BY PLANTING TREES

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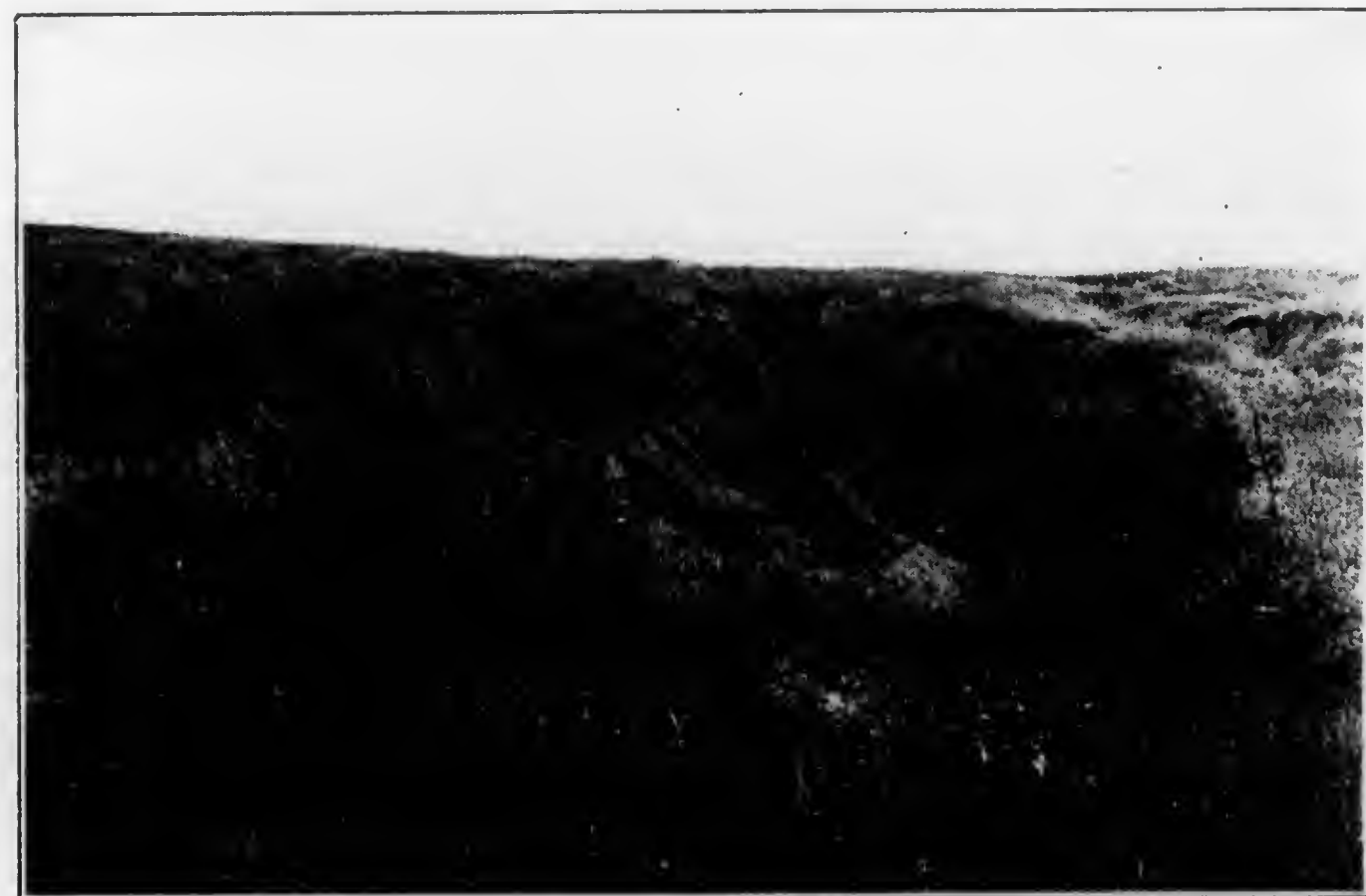
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A WELL-MANAGED WOODLOT CONTAINS TALL, STRAIGHT TREES OF VARIOUS KINDS AND SIZES



WELL-KEPT WOODLOTS ARE FILLED WITH SOUND, HEALTHY TREES

to \$5,029, and there remains approximately 250 cords of mill slabs, which he retails for fuel wood at \$1.25 per cord at the mill. The total expenses for cutting, logging and sawing amounted to \$2,600, leaving a net return of over \$2,429, or \$202 per acre. Mr. Warren still owns the land, which is ready to produce another crop of timber.

Mr. F. J. Market, Wilcox, Elk County, has 1,400 acres of timberland that he purchased for \$1.00 an acre 28 years ago immediately after it had been cut over. A careful estimate shows that the area will now produce 25 cords of chemical wood per acre, worth \$1.25 per cord stumpage, and 50,000 board feet of hemlock worth \$35 per thousand at the mill. Mr. Market says money invested in young timber yields a good rate of interest. Several young men in his neighborhood took his advice and bought up tracts to hold for the next crop of timber.

PUT WOOD IN YOUR WOODLOT

The day of cheap wood is gone forever in Pennsylvania. The time spent in caring for the woodlot will yield good financial returns when the products are marketed. Trees grow into money rapidly and when properly handled the products of the farm woodlands may be as valuable as the average agricultural crops in the locality.

Planting forest trees on steep hillsides and on poor, stony soils of the farm is a sure and safe way of building up a bank account for old age or the family that depends upon you. The idle acre on the farm is like the "boarder" in the dairy herd. It is not profitable to maintain either. Land that is too rocky, steep or poor to grow satisfactory agricultural crops can produce a good crop of timber trees. There seldom is a part of the farm so poor that it will not support tree growth.

Forest tree plantations and well kept woodlots will give the farm a higher value than is possible without them. Farm woodlands and windbreaks will protect dwellings, gardens, orchards and live stock against cold winds in winter and hot dry winds in summer. This will result in larger and better yields of grain, fruit and live stock.



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COMMONWEALTH OF PENNSYLVANIA
Department of Forests and Waters

What Follows Pulp
and
Chemical Wood Cuttings
in
Northern Pennsylvania

By
Harry E. Elliott, District Forester
Susquehannock Forest District



BULLETIN 43
(Special Studies Series)
1927

WITHDRAWN



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INTENTIONAL SECOND EXPOSURE

WHAT FOLLOWS PULP AND CHEMICAL WOOD CUTTING IN NORTHERN PENNSYLVANIA

BY

HARRY E. ELLIOTT, *District Forester*
Coudersport, Pennsylvania

A study of what follows pulp and chemical wood cutting in northern Pennsylvania was undertaken with the object of ascertaining the nature of the second growth following these operations. When a chemical or paper wood cutter has finished with an area, practically no tree growth except small seedlings is left. Tree stems and reasonably straight branch and limb wood are utilized to diameters of from two to three inches and in some cases even smaller material. All small trees and branches are removed and piled in windrows by the cutters, in order that they will have a clean space in which to work and pile the cordwood.

Three one-quarter acre sample plots were established in 1923 in the western part of Elk and adjoining parts of Cameron county, on lands of the Hall and Kaul Lumber Company of St. Mary's. As all measurements were taken in 1923, all other periods were computed in relation to that date. These plots were located on areas that were cut over three years, fourteen years, and twenty-three years prior to the time the records were taken. The soil in each case was a moist, fertile, and well drained loam. The ages of the different study plots represent the periods since cutting. These represent very closely the age of the stands. Practically the only growth left consists of a few small suppressed trees in the windrows, many of which are bent or broken off before the lumber operation is finished.

THREE YEARS AFTER CUTTING. (Plot I.)

This plot is located near Rathburn, Elk county, on lands that were first logged twenty-eight years ago for pine and hemlock, leaving large elm, butternut, basswood, and other hardwoods. Fires were kept out following the first cutting, and the same area was again cut over in 1920. The large trees were cut into logs and the smaller material, consisting principally of wild black cherry, beech, birch, and maple, was cut into paper wood. This operation yielded 30 cords of paper wood per acre. The brush left as a result of this cutting is rapidly going to pieces and in a short time will have entirely disappeared. The following data were collected on this plot:

Kind of Trees	Number of Trees	Percentage of Total Number of Trees
Fire Cherry	1,188	70.2
Wild Black Cherry	206	12.2
Yellow Birch	173	10.2
Hard Maple	77	4.5
Black Birch	13	.8
Elm	13	.8
Aspen	8	.5
Soft Maple	6	.3
Ash	3	.2
Hemlock	3	.2
American Hop Hornbeam	1	.05
Beech	1	.05
Total	1,692	100.00

NOTE

3

Pictures below
interchanged



A chemical wood operation the first spring following cutting. The chemical wood is stacked. Large material was cut into logs.



Scene of a chemical wood operation three years after cutting.

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INTENTIONAL SECOND EXPOSURE

FOURTEEN YEARS AFTER CUTTING. (Plot II.)

This plot is located on a rather steep north slope and was cut over for chemical wood fourteen years ago. A higher percentage of the trees on this plot is of sprout origin than on Plot I and Plot III. The branch and limb material resulting from this cutting has entirely disappeared. The trees average 25 feet in height. The following table was made up from data collected on this plot:

Kind of Trees	Number of Trees	Average Diameter (inches)	Percentage of Total Number of Trees
Hard Maple	193	1.48	45.3
American Elm	82	2.09	19.3
Yellow Birch	36	1.64	8.4
Basswood	34	3.68	8.0
Fire Cherry	32	2.70	7.5
Wild Black Cherry	25	3.20	5.9
White Ash	10	1.60	2.3
Black Birch	6	2.00	1.4
Beech	3	3.66	.7
Hemlock	3	1.00	.7
Striped Maple	2	3.00	.5
Total	426	2.00	100.0



A thrifty young stand of Beech, Birch and Maple in Potter county, Pa., fifteen years after chemical wood cutting.

TWENTY-THREE YEARS AFTER CUTTING. (Plot III.)

This plot is located on a plateau characteristic of the region and is surrounded by about 2,000 acres supporting the same kind of growth. This area has never been damaged by fire. The original stands were chiefly hardwoods and were noted for the fine wild black cherry which

they contained. A chemical wood cutting was made on these lands twenty-three years previous to the laying out of the sample plots. The tree growth averaged 30 feet in height. The data on this plot are given in the following table:

Kind of Trees	Number of Trees	Average Diameter (inches)	Percentage of Total Number of Trees
Hard Maple	164	3.18	51.9
Wild Black Cherry	41	5.47	13.0
Yellow Birch	28	2.93	8.9
Fire Cherry	27	3.85	8.5
Beech	22	2.50	7.0
Black Birch	12	2.84	3.8
Chestnut	10	4.20	3.2
White Ash	9	3.00	2.8
Red Oak	2	7.00	.6
Cucumber	1	4.00	.3
Total	316	3.50	100.0

The advance growth on all the areas studied consists of fire cherry and briars. The valuable species either followed or came in at the same time as the nurse crop. The former gradually suppressed and killed off the nurse trees. It was found from observation and from these studies that the older the stands of trees become the higher is the percentage of desirable species in the stand.

The stands previously cut clean for chemical or paper wood have not yet reached an age suitable for a second lumbering. It is therefore, rather difficult at the present time to procure accurate data on volume growth.

On the lands of Floyd Peet near Coudersport a second chemical wood cutting was made in an eighteen-year-old stand. Mr. Peet's records and those of the Gray Chemical Company show that 136 stacked cords of wood were removed from an area of 8.5 acres. This shows an average of sixteen cords per acre at the age of eighteen years or a growth of almost one cord per acre per year.

Robert Lyman, Forester for the Gray Chemical Company, supplied the following yield data collected from even-aged stands that resulted from severe wind-falls:

Plot	Area (acres)	Age of Plot (years)	Stacked Cords of Chemical Wood per Acre
I	1	25	23
II	1	45	45
III	1	80	79

CONCLUSIONS

1. Practically no tree growth larger than seedling size, except scattered defective trees and some specimens of undesirable species, is left after chemical wood and pulpwood operations.

2. Many small seedling trees and sprouts are destroyed by the wood cutters to clear spaces to work and to pile and transport the wood. If from careful study, a practical plan can be developed to regulate this

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practice, the make-up of the tree crop that will follow can be improved. It must be borne in mind, however, that paper and chemical wood is harvested for a profit, and any plan devised to change the present manner of cutting, piling and other operations, must take this fact into consideration.

3. Except in very unfavorable situations, enough seeds, seedlings, and sprouts are present on the cut-over areas to restock them completely.

4. Forest fire is the worst enemy on these cut-over lands. The fire hazard is greatest during the first five years after cutting, when enormous quantities of brush remain on the lumbered areas in piles, in windrows, or spread broadcast. Three years after cutting some semi-decayed slash is left. At five years practically all small size slash has disappeared. At nine years only the larger branches remain and these crumble when stepped upon. At fourteen years all slash has disappeared. In my opinion the serious fire hazard is past at about eight years after cutting.

5. While maple, beech, and birch produce most of the wood derived from the lumbering operations, fire cherry is the principal tree that springs up immediately after lumbering. Plot I shows that three years after cutting, fire cherry (70 per cent), black cherry (12 per cent), yellow birch (10 per cent), and hard maple (5 per cent) made up 97 per cent of the trees in the young developing stand. In support of these field data, I also offer the results collected on a sample plot established in Potter county in 1923 by Forester J. N. Morton, two years after lumbering. Fire cherry made up 50 per cent, hard maple 41 per cent, wild black cherry 4 per cent and beech 3 per cent of the total number of young trees. These four species made up 98 per cent of the oncoming young growth. Fire cherry was the most abundant tree in this plot. It remains the leading tree until the stands are about eight years old.

6. In the early stages of development of the young stands that spring up on the cut-over areas, a great change takes place in the composition and in the number of trees per unit of area. Valuable forest trees, chiefly maple, beech, and birch, often with a considerable mixture of wild black cherry, gradually replace the inferior fire cherry in the development of the forest stands. At the age of fourteen years (Plot II) more than 94 per cent of the stand is made up of hard maple (45 per cent), American elm (19 per cent), yellow birch (8.5 per cent), basswood (8 per cent), fire cherry (7.5 per cent), and wild black cherry (6 per cent). The fire cherry is rapidly losing out and the better trees are beginning to dominate in the stand. Only 128 fire cherry trees remain per acre as against 4,752 per acre at the age of three years.

7. At twenty-three years (Plot III) practically all the fire cherry and other inferior species have disappeared, and the permanent maple, beech, and birch Forest Type is in complete control of the situation. The number of trees per acre has been reduced to about 1,250. At twenty-three years the trees average 30 feet in height and from 2.5 to 7 inches in diameter, with an average of 3.5 inches.

8. Yield studies in Potter county show that seventeen-year-old stands produced an average annual growth of fifty-three cubic feet per acre. At thirty years an average annual growth of one cord per acre per year is assured, if forest fires are kept out of the woods. With this rate of

tree growth the kind of material used by the hardwood distillation plants and the pulp mills can be produced in thirty to forty years, depending upon the site. This means a possible rotation of thirty to forty years, which is probably the shortest that is practicable in supplying the needs of any big wood-using industry. The owners of these chemical wood and pulpwood lands are beginning to see the possibilities in good forest practices, and to this end are taking practical steps in the control of forest fires, which will go far to insure successive wood crops for their plants.

Forest Tree Nursery Practice

By
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Chief, Bureau of Forest Extension



Bulletin 44

Commonwealth of Pennsylvania
Department of Forests and Waters

Charles E. Dorworth, Secretary
Joseph S. Illick, State Forester

Harrisburg

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Forest Tree Nursery Practice

Forest tree planting in the United States has been growing by leaps and bounds. No longer is it considered a pastime for the theorist nor a hobby for the conservationist. Forest land owners, from the sidehill farmer to the million dollar corporation, have accepted it as a necessity and are joining the rapidly growing tree planting army. Private forest tree nurseries may be expected to assist the State and Federal Nurseries in supplying the tree planting stock. In fact, private forest tree nurseries are already with us. The owners of large tracts of forest lands have established extensive nurseries for growing forest trees for planting on their idle acres, and tree lovers are establishing small nurseries because of their interest in the work. These private land owners should have the latest and most practical information on forest tree nursery practice, so that trees may be produced by the cheapest and most satisfactory methods. The growing of forest tree seedlings and transplants is interesting but exacting work. Great care is required in preparing the nursery area, planting the seeds, caring for the seedlings and shipping the trees. In fact, some of the nursery operations are so essential that a lack of proper care at certain periods will mean the loss of a large number of trees. For this reason, persons desiring to grow forest tree seedlings and transplants should acquaint themselves with the details before undertaking the work.

State Forestry Departments charged with the duty of encouraging the practice of forestry may assist individuals and corporations who are conducting their own forest tree nurseries, by publishing the results gained in nursery practice. The methods described herein are followed in the Pennsylvania State Forest Tree Nurseries, where approximately 15,000,000 seedlings and transplants are grown each year for reforestation in Pennsylvania.

SOIL PREPARATION AND BED MAKING

Light sandy loam soil is best for growing conifers and small seeded hardwoods, since this soil may be worked early in the spring, and soon after showers during the growing season; in addition, it does not bake or heave, and is easily cultivated. The production of the greatest number of stocky trees requires the best possible soil conditions, both as to texture and fertility. Convenience in future work requires the removal of all stones that come to the surface. Large stones may be hand picked and smaller ones raked in piles, then worked over a sand screen that has the lower end in a wheelbarrow, and hauled away. After the stones have been removed the ground should be plowed as deep as the point of the plow can be made to run. Any stones that are brought to the surface by the plowing should be hand picked, but no attempt need be made at this time to rake up the smaller ones. The area is worked over many times with a spring tooth or disc harrow, first lengthwise of the furrow, then crosswise, then zigzag, in an effort to carry the

soil to low and uneven spots. Afterwards stones should again be hand picked. The top soil is next leveled with a spike tooth harrow and pulverized with a "cultipacker." A float dragged upside down also will carry soil into depressions and assist in pulverizing the top soil. The harrow and "cultipacker" or float should be worked until the soil is thoroughly pulverized and as level as it can be made.

The best results will be obtained if the area lies fallow the summer before the tree seeds are planted. Field peas or soy beans may be sown and as soon as the vines or bushes show the first blossoms the crop should be plowed under. The ground is then allowed to settle for a few days and the area dragged and sowed again. Frequently, it is possible to sow peas three times in one year. If the fall is late the vines from the last sowing will be large enough to give good results when turned under.

Sod should not be turned down and the area sown or planted in the same season with forest tree seeds. The weeds and grass will come up thickly in the seed beds and cause unnecessary labor in removing them. When tree seeds are to be sown in the spring the ground should be plowed and harrowed late the preceding autumn. In the spring the area should be plowed again and harrowed from two to five times until the soil is in prime condition. Coarse, unrotted manure never should be applied immediately before the beds are to be thrown up. It will cause trouble in working the beds, as well as loss of plants in dry weather.

After the soil has been thoroughly cultivated with the harrow and "cultipacker," the beds should be staked out. A bed four feet wide has been found to be the most convenient, and has been adopted as the standard width for the Pennsylvania State Nurseries. This is the maximum width for convenient hand weeding, and such a bed 25 feet long gives a "unit bed" area of 100 square feet, which is helpful in calculating the amount of seed for sowing, the inventories, and seedling costs. Longer beds are used where convenience demands it. Paths between beds should be one and one-half to two feet wide, and alleys three feet wide between the ends of the beds permit the use of wheelbarrows, spray tanks and other nursery implements. When beds are longer than twenty-five feet the end paths may be six feet wide to permit piling of shades and moving equipment and tools. A large nursery should be divided into blocks of convenient size surrounded by roads nine to fifteen feet wide for driving, piling shades, stakes and other equipment. The margin of the bed area should also be wide enough for these uses.

The corners of the end beds on areas used year after year may be marked with iron pins set with tops level with the ground. Wooden stakes used to demarcate beds temporarily should be two by one inches, and eighteen inches long, set one at each corner until the beds have been thrown up and raked smooth. After the stakes for each bed in a section are placed and the lines between them placed in position, the soil in the paths is thrown on top of the beds to a depth of three to six inches, depending upon its texture.

Half of the soil is thrown on the beds to each side of the path. The worker "carries the bottom of his path" to get the grade from the upper to the lower end of the bed. End paths are not spaded and are seldom thrown into beds. In small nurseries, beds are thrown up with a round pointed, long handled shovel, but in large nurseries paths are made and beds thrown up with a double mold board plow or a small one-man road grader.



Paths are made and beds thrown up with a double mold board plow

After sufficient beds are thrown up for convenient working by the crew, the lines around each bed are checked carefully. These lines remain until the beds are ready for the seed. In laying out beds, great care and extra time are taken to get the lines true. One stake out of line catches the tools and garments of the workers, and an untrue path throws the surface water into, and often partly through the beds. Care should be taken to have the lines on the outside of the stakes give the beds a width of exactly four feet.

Soil must not be worked when it is wet. The working crew may lay out additional beds or do other work, while the air dries the soil already thrown into the beds. The soil is pulverized and all stones and clods are raked to the path and removed with wheelbarrows after seeding is completed. The beds are usually raked several inches beyond the side lines. The surface of the beds should be about four inches higher than the paths but it may be necessary to make them higher, at moist locations, to permit them to dry out properly. The beds usually are worked with heavy 10-tooth steel rakes. In light sandy soil ordinary garden rakes are satisfactory. The men work by two's, one on each side of a bed. Raking the beds is very trying work, as the constant jar, even if the stroke is light, tires the arms and back; but no operation in the nursery is more important. The nurseryman must be on constant watch to see that this work is not slighted. It is believed that the time is not far distant when a nursery implement will be devised that will do

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away with the rough raking work now done by hand. When raking is completed the beds will carry a level to correspond with the slope of the paths. Soil from the end paths may be used to fill depressions and build up the beds so that they will have proper drainage. When the end path soil is used, it is pulverized before being wheeled to those parts of the beds where needed. Every low point should be filled in and worked until the entire bed is as nearly level as it can be made. Beds should never be lower in the middle than at the sides, as this retards drainage and causes loss from "damping-off." In light, sandy soils the tops of the beds may be about level, but on heavy clay soils the surface should be convex, from one to one and one-half inches higher in the center than on the sides. Heavy soil may be improved by mixing charcoal braze or sand with it, before the beds are raked. In raking, the degree of care required depends somewhat upon the size of the seed. Smooth, even beds, such as a gardner would prepare for sowing lettuce, are the ideal for small seeds, such as those of pines, spruces and larches.

In all bed making the aim is to obtain a thoroughly worked mellow soil for a depth of about ten inches. The first cost of a thoroughly prepared bed is but a fraction of a cent more per square foot than a less thoroughly prepared one. The loss of a single thousand seedlings will amount to more than the extra cost of doing the work properly. The expenses in succeeding years, will be greatly reduced by a thorough working when the beds are first thrown up. After the beds are leveled, a mixture of raw bone meal is raked lightly into the surface soil. Some nurserymen apply bone meal before the area is harrowed. A thin layer of compost, fine charcoal or woods soil, may be applied and lightly raked into the ground immediately before planting.

SOWING SEEDS AND CARE OF BEDS PRIOR TO GERMINATION

Seeding should be done as early in spring or as late in fall as is consistent with the proper preparation of the ground. Seedlings from late sown seed do not develop so well as those from early sowing. Moreover, germination requires a longer time and is not as satisfactory, while damping-off is more serious. Fall planting has given the best results with red and white pine and may be best for exotic seeds. However, the current season's crop of exotic seeds cannot as a rule be gotten in time for fall sowing.

When cheap labor and plenty of land are available, sowing seed in drills across or lengthwise of the beds is probably best, since it permits cultivation, requires only about half as much seed for a given area as broadcasting, results in better germination, permits more space for root development, and allows the use of exact mechanical devices for seed dispersal. However, broadcast seed sowing is entirely satisfactory and more economical and this method is used in the Pennsylvania State Nurseries.

The amount of seed to be used per hundred square feet of bed surface depends on the number of seeds per pound and its germination percentage. For white pine seed of average quality, ten ounces or slightly less, is sufficient, while for most of the smaller



The use of a seeding frame will assure the full width of each bed for seedling production



The results of the seed frame with two-year-old spruce showing open spaces that assist in preventing the growth of small seedlings in the center of the bed by giving them more light and space for root development

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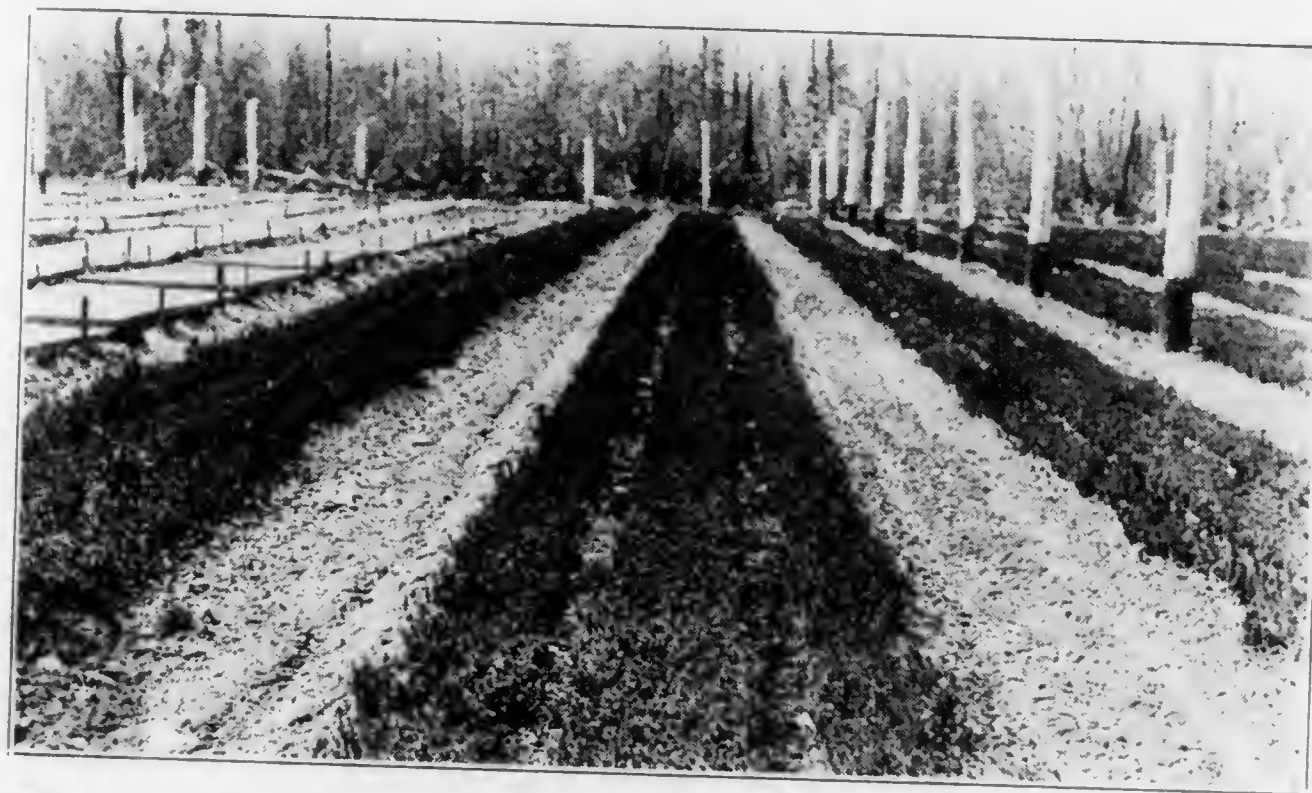
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and sowed by hand. It is scattered very thinly at first, and the entire bed is gone over twice. This usually gives very even distribution after the sower has had a little practice. Rolling the beds before the seed is sown will make the surface of the bed smooth and will facilitate even distribution of the seed.

A seeding frame four by twelve and one-half feet is used by placing it on each bed and sowing the seed inside this frame. This will assure the full width of four feet on each bed for seedling production. The frame is moved along the line after each fifty square feet of bed is seeded. This frame is made with strips of wood two inches wide and one inch thick. To assist in preventing the growth of small trees in the center of the bed, by giving the trees more light and more space for root development, one and sometimes two spaces six inches wide and running lengthwise are made in the frame by inserting one by two inch strips, and no seed is sown in these openings. The same results are secured by sowing a smaller quantity of seed in the center of the bed than along the sides. The seed frame will be found invaluable when large areas are sown.

The use of red lead on seed sown in autumn is not effective as a deterrent to damage by birds and mice, but it should be used on all seed sown in spring if it is subject to loss. It will not entirely eliminate damage from these causes, but it will aid in doing it. Red lead may be applied when seed is being weighed out. The seed is moistened and a small quantity of red lead, as much as will adhere to the seed, is thoroughly mixed with it. Approximately a teaspoonful of red lead will usually be required for each pound of coniferous seed treated. Even distribution of the seed in the bed is facilitated by the color imparted by the red lead.

The next step is to press the seed into the soil. This may be done in small nurseries with a pressing board, about four and one-half by two and one-half feet, which is manipulated by a man on each side of the bed to move it along and step on it. The pressing board is too slow when large numbers of beds are sown. A better method is the use of a roller not less than three feet in diameter and five feet wide which is rolled over the beds. This roller may be concave, so that the bed will be higher in the center than at the sides, but this is not usually essential. A roller of small diameter will push the soil ahead of it instead of pressing the seed into the ground.

In the spring, if the soil is dry, the beds should be well watered before sowing or immediately after the mulch has been applied. This will assist in securing quick germination.

The seed should be covered to a depth of one to two times its largest dimension. Well rotted compost or woods soil is best for this purpose, although charcoal braze has given excellent results. Sand has been successfully used on pitch, Scotch and other "hard pines." It can be used on white pine, especially when sown in autumn, but it is too hot for use with most other small seeded trees. The chief advantage of sand lies in its relative freedom from weed seeds and spores of fungi. Ordinary loam soil may be used in covering seed, but it is not as satisfactory as woods soil,

compost or sand for use on seeds to which they are respectively adapted. The cover is usually applied by sifting. A box two by three feet and ten inches deep, equipped with a wire mesh bottom, and handles at each end for the two men who operate it, is used for this purpose. Experiments have been made with spreading



Seed is pressed into the soil by using a large roller at least three feet in diameter

machines with a forced feed especially adapted for sifting cover on the beds, and an efficient machine is believed to have been developed. For applying sand, wire with four meshes per inch is best, while three meshes per inch is most satisfactory for compost or woods soil.

After the seed has been covered, the beds should be mulched with about an inch of leaves, pine needles or straw that is free from weed seeds. Sea grass or rye straw that has been cut before it is mature contains no weeds and constitutes a very good mulch. Burlap and heavy paper have been used with success. Shades and stakes are placed on the mulch to hold it in place. The purpose of this mulch is to give uniform and favorable soil moisture and temperature conditions for germination.

CARE OF SEED BEDS AFTER GERMINATION

This work is started by carefully raking off the mulch from the beds of germinating seed. The mulch should remain on the beds until approximately half of the seeds have begun to push through

and sowed by hand. It is scattered very thinly at first, and the entire bed is gone over twice. This usually gives very even distribution after the sower has had a little practice. Rolling the beds before the seed is sown will make the surface of the bed smooth and will facilitate even distribution of the seed.

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the soil. If germination is slow and irregular, the mulch must be removed before the earliest germinating plants become weakened. Daily examination is necessary at this time to determine the proper date for removal of the mulch. If extreme care is not used now, some of the seedlings may be severely injured or killed. This work should be done preferably on cool or cloudy days, or in the forenoon before nine o'clock and after four o'clock in the afternoon. Beds must not be allowed to dry out nor to be soaked with water at this time if it can be avoided. Light sprinkling or gentle showers are most favorable.

Shades are erected immediately after the mulch is removed. The most convenient shades are made of strips one-half inch thick, two inches wide and four feet long, nailed to two nine foot by one by two inch beams, spacing the lath strips nearly or quite their own width, so as to get approximately half-shade conditions beneath



Method of erecting shades in the Greenwood Nursery

them. These shades are supported by two inch square stakes two and one-half feet long, firmly driven in pairs on opposite sides of the beds, with cross pieces tacked on top of the stakes. The cross pieces four feet long, may be of one by two inch material. This will hold the shades about eighteen inches above the level of the beds, and permit hand weeding from the sides without removing them. If the beds are laid out east and west the direct rays of the early morning and late afternoon sun will strike the least number of seedlings. Where possible, this general direction for beds should be used.

For most coniferous seedlings, half shade is sufficient. Some of the light-demanding pines and the hardwoods may be grown without shade, but with practically all species growth is best if shaded until August or September of the first season. Shading also tends to make weeding easier. Spruce and hemlock do best if given full shade during sunny weather for six weeks following removal of the

mulch. This may be effected by placing burlap or kraft paper over the usual form of shades, or by temporarily fitting lath in the openings in the shades.

Birds may do serious damage to seed beds by picking the seed cap from the recently germinated seedlings. Some nurserymen place a frame covered with wire netting over the beds to exclude them. However, since the period during which birds will do serious harm is limited to a week or ten days, and then only during parts of the day, it is much cheaper in large nurseries to have boys watch the beds during this period and prevent birds from working on the seedlings.

Weeding the seed beds and paths must not be neglected during the first season. Weeds in the beds must be hand pulled when small to prevent uprooting or fatal loosening of the small, tender trees. In three days of warm wet weather weeds will grow large



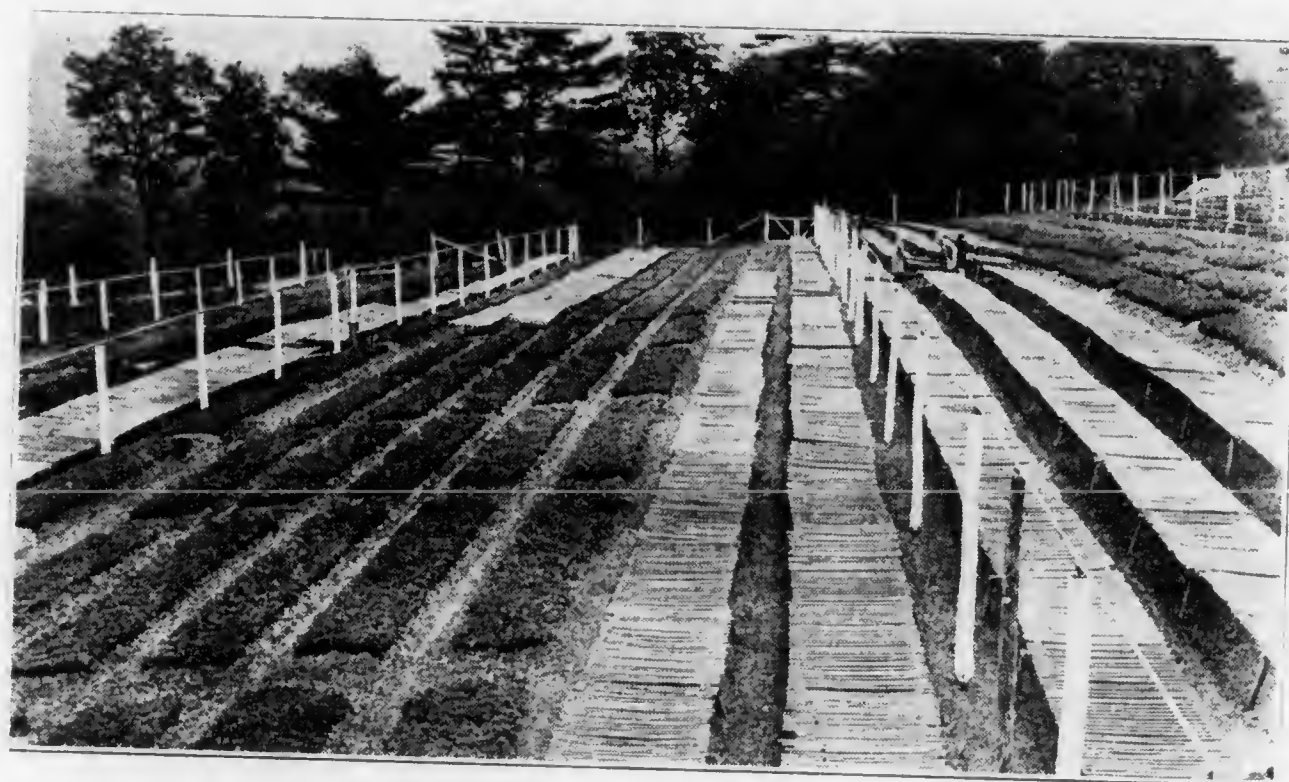
Permanent overhead water system at the Clearfield Nursery

enough to become a serious problem. If weeds are permitted to get large, many seedlings will be lost when the weeds are removed. Five or six thorough weedings are usually necessary between the time of germination and the first killing frost in autumn. Paths are hoed, or may be worked with a one-horse cultivator.

During the growing months of June, July and August, the beds should be watered whenever three days of sunshine have passed without showers. Until germination is complete, water should be applied sparingly every day or two, but later, thorough wetting down not oftener than every third day seems best. Early morning before the sun falls on the beds, in the evening after five o'clock, or during the night, are the best times for application of water directly to the trees. Water may be applied by sprinkling the surface of the beds with hose from a spray nozzle or from stationary irrigation lines. If the supply of water is abundant and the nursery is about level, the paths may be flooded so that the trees re-

the soil. If germination is slow and irregular, the mulch must be removed before the earliest germinating plants become weakened. Daily examination is necessary at this time to determine the proper date for removal of the mulch. If extreme care is not used now, some of the seedlings may be severely injured or killed. This work should be done preferably on cool or cloudy days, or in the forenoon before nine o'clock and after four o'clock in the afternoon. Beds must not be allowed to dry out nor to be soaked with water at this time if it can be avoided. Light sprinkling or gentle showers are most favorable.

Shades are erected immediately after the mulch is removed. The most convenient shades are made of strips one-half inch thick, two inches wide and four feet long, nailed to two nine foot by one by two inch beams, spacing the lath strips nearly or quite their own width, so as to get approximately half-shade conditions beneath



Method of erecting shades in the Greenwood Nursery

them. These shades are supported by two inch square stakes two and one-half feet long, firmly driven in pairs on opposite sides of the beds, with cross pieces tacked on top of the stakes. The cross pieces four feet long, may be of one by two inch material. This will hold the shades about eighteen inches above the level of the beds, and permit hand weeding from the sides without removing them. If the beds are laid out east and west the direct rays of the early morning and late afternoon sun will strike the least number of seedlings. Where possible, this general direction for beds should be used.

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ceive moisture by capillarity. Where the flooding method of watering is used on open, sandy sites, it must be done before the soil becomes excessively dry, else the trees may be "sun scorched" in the middle of the beds before water reaches their roots. Stationary overhead irrigation lines with spray nozzles every three feet give the most satisfactory results. They are used in the Pennsylvania State Nurseries. Artificial watering is essential for the best growth of one year old seedlings, but two and three year old trees will grow fairly well without it.

In the latter part of September the shades should be removed from the beds so that the trees will be exposed to the full effects of sunlight and frost. This will check further growth and mature the wood before winter sets in.



The winter mulch is most cheaply applied from a wagon or cart with a wide spread between the wheels that may be driven over the beds while the wheels are in the paths

After the ground has frozen a few times and the leaves have fallen in the forest, seedling beds with trees of the current season should be carefully mulched with straw, leaves or pine needles. In large nurseries this mulch is most cheaply applied from a wagon with a wide spread between the wheels, so that it may be driven over the bed while the wheels are in the paths. This "winter cover" need not be heavy, about one inch or less in thickness, but it should be complete and evenly spread. The edges and ends of the beds need the heaviest cover, especially on beds with a gentle southern exposure, because at these places frost-heaving is most severe. If leaves are used for winter cover, they are held in place by laying shades upon them. Leaves should be removed promptly in spring, as they may cause the young trees to mold or mildew during the first warm days of spring. This is a common occurrence if the mulch has been held in place and pressed tightly to the ground by heavy weights. When in doubt as to whether freezing weather

is past, the shades may be removed so that the wind will gradually loosen up the leaves and straw and blow them away.

CARE OF TWO AND THREE YEAR OLD SEEDLINGS

The care of two and three year old trees is practically limited to weeding. Watering, as each week passes without a soaking rain in June, July and August will stimulate growth, but is not essential. Expenses may be reduced in weeding the paths by using a horse cultivator set narrow and shallow, but some hoeing or hand pulling is always necessary to get out all weeds and uncover trees that have been buried by cultivation.

As a rule two and three year old trees do not need winter cover, but if beds are sparsely stocked or the soil is wet and poorly drained, a thin mulch for spruce and other shallow rooted species will not be amiss during their second winter.

COMMON FUNGOUS AND INSECT TROUBLES

The so-called "DAMPING-OFF" diseases attack seedlings of nearly all tree species as soon as, or even before, they emerge from the ground. The specific fungi causing this loss are almost legion. It is easy to note that some are subterranean in their attack, others weaken the plants just at the surface of the soil, while other forms affect the crown of the seedling and cause its needles to draw together at the tips and quickly wither away. Losses due to damping-off practically always occur, though at times they may be negligible. It is safe to say that these fungi are the most serious sources of loss in forest nurseries. Sometimes all trees in promising beds may be killed off in two or three days.

Slightly acid soil seems to be partially exempt from serious loss due to this cause. Treatment of soil before planting, with aluminum sulphate, dilute sulphuric acid, formaldehyde and other chemicals may prevent or limit damping-off. These chemicals must be used in the correct proportions. If the solution is weak, results will not be satisfactory; if too strong the trees may be killed. The correct proportions for a specific soil can only be determined by experiments. Too much moisture in the soil and air, and warm temperatures, are the factors that encourage serious loss from damping-off fungi. The most effective remedial measure used to combat damping-off fungi is to spray attacked beds with Bordeaux mixture as soon as trouble is detected. Removal of shades from beds during and immediately after wet weather, thus quickly drying out the beds and reducing the soil moisture content below the danger point, is also helpful. As soon as the soil seems dry on top, shades must be replaced, or loss will result from intensity of direct sunlight on the tender trees.

Six weeks after germination, trees are usually woody enough to be safely resistant to damping-off troubles.

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It is worse in very densely stocked beds and may completely destroy all seedlings over considerable areas. The trouble is most common in the middle of the beds. The leaves turn yellow and wither. Shedding disease is distinguished from sun-scorch, which it most closely resembles, by the fact that it develops or attacks the tree from the ground upward, while the injury by hot sun may be limited to the upper needles and growing tips of the trees. Both of these troubles usually become noticeable in time of drought. Like the damping-off fungi, shedding spreads most rapidly during moist, hot weather, but its effects are not visible until later. Remedial measures consist of thoroughly spraying affected spots and adjacent areas with Bordeaux mixture, after each rain during the succeeding warm weather.

Aphids must be watched for constantly. Once started they constitute a very persistent nursery trouble. They may be found in the soil near one year old seedlings, but are not common until late



The Greenwood steaming pan. It is used to sterilize nursery soils before sowing with tree seed

in the second year. Aphids may be overcome by applying a solution of two pounds of fish oil soap, two and one-half ounces "Black Leaf Forty," and sixteen gallons of water. When aphids are observed on seedlings lifted for shipment, the trees should be dipped several times in a solution of four pounds fish oil soap, one pint "Black Leaf Forty" and one hundred gallons of water. It is needless to say that no trees should be shipped from the nursery that have living aphids upon them.

The larva of the MAY BEETLE, commonly called WHITE GRUB, is a great destroyer of seedlings. This grub feeds on the roots of coniferous and hardwood seedlings. The former are usually killed, but the latter frequently are able to survive the attacks. The best results in exterminating it are obtained by teaching weeders to identify the seedlings which have been attacked and have them notify the nurseryman, who will follow the galleries until the worm

is found. The grub works shallow or deep, according to the heat and moisture in the soil. It travels rapidly and does not follow a fixed course. The use of coal tar, carbon bisulphide and other chemicals during the active growing season, when the grubs are near the surface, does not appear to lessen the damage. Neither has the use of bright light about the nurseries, to attract and destroy the mature beetles before the eggs are deposited, been successful. Sterilization of nursery soils by steam, before the seeds are planted, kills all life to a depth of fourteen inches and appears to be the most effective remedy.



The steaming pan in operation. The soil is baked to a depth of fourteen inches

As a tonic for seedlings that are off color or those that do not keep up an average growth, spraying with a solution of one tablespoon of nitrate of soda to one gallon of water is effective. This solution is mixed in open top barrels and applied to two and three year seedlings from a twelve quart sprinkling can. The mixture must be stirred to keep the soda near the top. It should not be used more often than once in three weeks during the growing season.

TRANSPLANTING AND CARE OF FOREST TRANSPLANTS

Beds in which transplants are to be set are prepared and raked nearly as smooth as for seed sowing. A transplant board invented by Mr. T. O. Bietsch, of the Pennsylvania Department of Forests and Waters, is commonly used for setting the seedlings. This board is four to eight feet long and has coiled springs to hold the seedlings in place.

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the trenching board nearly vertical. Over this side, the transplant board holding from thirty to sixty seedlings, is held while earth is drawn into the trench and tamped solidly about the roots of the trees. The board is then disengaged and passed back to boys who refill or "thread" it with trees.

A foreman will supervise two crews of four planters, six board fillers and two seedling carriers. The planting boards are filled at tables, over which a three-sided shelter with a roof should be provided to prevent the wind and sun from drying out the seedlings. The roots of the seedlings are kept moist at all times. The main seedling supply is kept in tubs partially filled with water. The



Forest transplants grown in rows twelve inches apart

carriers keep a supply of seedlings on the table and take the filled boards to the planters, who dig the trenches and set the trees.

Weeds are kept down in transplant beds by hand pulling and shallow hoeing. The latter is preferable and if carried out after each rain will largely eliminate the necessity of irrigation.

When a large area of land is available and trees are transplanted in rows extending across the tract, the rows are scored out with a commercial trenching implement and special care is used to make the rows straight. A tobacco planter is not successful in setting the trees in rows. The trees may be planted with transplant boards six to eight feet long, spacing the trees from two to six inches in rows twelve to thirty inches apart. These transplant rows are cultivated every two weeks to keep down the weeds. They may be hoed by hand on small areas. On large areas a small power or horse cultivator will do the work cheaply and efficiently.

Transplant beds need not be weeded or cultivated after October first, as any weeds coming on them will help to prevent heaving of the trees by frost. However, it is very essential that no weeds are permitted to go to seed. It is advisable, although not absolutely necessary, to give transplants a light winter cover of straw, pine needles or leaves during their first winter.

LIFTING AND PACKING TREES

Good strong four-tined spading forks have been found most practical in loosening and lifting coniferous seedlings and transplants grown in a small nursery. Beds are attacked at the ends and



The Clearfield seedling lifter is drawn by a tractor



The Greenwood tree lifter may be operated with two heavy horses

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edges, loosening the soil and trees in clumps a foot or less in diameter. These trees are shaken free of adhering soil and passed back to "sorters" who discard the small and unhealthy trees and tie the others in bundles of 25, 50 or 100—depending upon the size and age of the stock. Tree lifters, operated by tractor or horsepower are cheapest, where large numbers of trees are to be removed. Two types of mechanical tree lifters are in use in the Pennsylvania Forest Tree Nurseries. A steel blade three-eighths of an inch thick, twelve inches wide and four feet long, supported by a very heavy iron frame, is drawn ten inches below the surface of the seed beds by a tractor or two heavy horses. This blade loosens the trees so that the soil may be shaken from the roots and the trees counted,



Forest tree nursery packing and shipping building

sorted and bunched. A Commercial Shrub Digger, consisting of a "U" shaped steel blade mounted on wheels and drawn by two horses, is effective in lifting any trees that are planted in rows more than eighteen inches apart. It is especially well adapted to lifting oak, locust, walnut and other hardwoods. Tree lifting machines are not only cheap to operate but they are most valuable because the entire root systems are lifted with the trees. This result cannot be obtained as satisfactorily when the trees are loosened with a fork.

In pleasant weather, counting and bunching is most rapidly done in the field where trees may be "heeled-in" on the spot until time of packing and shipment, but on cold days it must be done in the packing house or some other suitable building. Vegetable tying machines have been tried but have not proven entirely successful for tying forest tree seedlings and transplants. If trees are to be

shipped in three or four days, they need not be "heeled-in," but may be built up in stacks or double ranks in the packing house, the roots turned inward and somewhat overlapping with layers of moist sphagnum moss alternating with layers of the tree roots, as in packing for shipment. Trees may be kept this way for ten days or two weeks if growth activities have not begun, but they should be examined daily, as there is always some danger that they may "heat" or dry out.

The main requisite in packing trees for shipment is to keep the roots moist and protected from air, and to permit the tops to have adequate ventilation while in transit. This is secured by the liberal use of moist sphagnum moss around the roots, and ventilation for the tops when the trees are packed. In shipping evergreens the



One thousand seedlings packed for shipment by parcel post

roots are always packed inward and so protected on the outside of the crate by waterproof paper that the moist moss scattered through and around them has no chance to dry out. All trees should be packed tightly in the cartons, boxes or crates so that there will be no danger of shifting in transit. This usually results in damage to buds, or drying out of roots.

Hardwood seedlings are handled as conifers, except that tap rooted trees when lifted by hand are most rapidly dug with a long, sharp-bladed spade instead of a fork. A commercial shrub lifter should be used whenever possible so that the entire root system may be saved. Roots of hardwood trees form a larger bulk than their tops; hence in packing trees two or three feet long, crates are made

tight at ends or sides and roots are packed outward, allowing the tops to overlap in the middle. Danger of the roots drying out is not so serious with hardwoods as conifers.

Shipping boxes are ventilated by holes or cracks so the air may reach the tops of the trees. When the trees are packed, a layer of wet moss is placed in the box where the roots will rest, and the first tier of seedlings placed in position. More wet moss is placed on these roots, then another layer of seedlings, and so on until the box is filled. Crates made of one-half inch or one inch boards are used for large shipments, and veneer crates for medium large shipments, both of which are forwarded by express. Small shipments are sent by parcel post.

When packing trees for shipment by parcel post, the trees are bunched with wet moss around the roots, waterproof paper is tied tightly around the roots and moss, and the tops of the trees are exposed. In this form they are placed in the container and mailed. Corrugated or fiber board cartons held together with tape should not be used in shipping trees, since moisture from the moss may loosen the glue and the carton will come apart. Steel stapled corrugated or fiber board boxes, made from 100 to 250 pound test board, have been most satisfactory. Mailing tubes constructed with waterproof paper, reinforced with cardboard, are satisfactory in carrying shipments of 100 or 200 trees by parcel post.

NURSERY METHODS

The methods used in growing trees for reforestation will vary with the quality of the soil, the slope of the nursery area, the climate and other factors. Those given above are not to be considered as the only methods by which forest trees for planting may be grown cheaply and satisfactorily, but they have been decided upon as most acceptable for Pennsylvania conditions. Since labor is the most expensive factor in growing seedlings and transplants, new labor-saving tools and implements are constantly being devised. A nurseryman will observe and determine for himself the methods that best suit his conditions and enable him to grow well rooted trees at the lowest possible cost.

STATE FOREST TREE NURSERIES OF PENNSYLVANIA

Department Nurseries

- Clearfield Nursery Nine miles northwest of Clearfield, along Clearfield-Penfield road. Moshannon State Forest.
- Greenwood Nursery Accessible from Lewistown by way of Belleville, and from Huntingdon by way of McAlevysfort. Logan State Forest.
- Milton Nursery Along Susquehanna Trail, between Milton and Sunbury.
- Mont Alto Nursery Pennsylvania State Forest School, Mont Alto, 12 miles south of Chambersburg and 6 miles north of Waynesboro. Mont Alto State Forest.
- Penn Nursery Potter's Mills, along Lewistown-Bellefonte Highway. Penn State Forest.

Cooperative Institutional Nurseries

- Danville Nursery State Hospital, Danville.
- Harrisburg Nursery State Hospital, Harrisburg.
- Huntingdon Nursery Industrial Reformatory, Huntingdon.
- Polk Nursery Polk State School, Polk.
- Rockview Nursery Western Penitentiary, Rockview.
- Torrance Nursery State Hospital, Torrance.
- Wernersville Nursery ... State Hospital, Wernersville.

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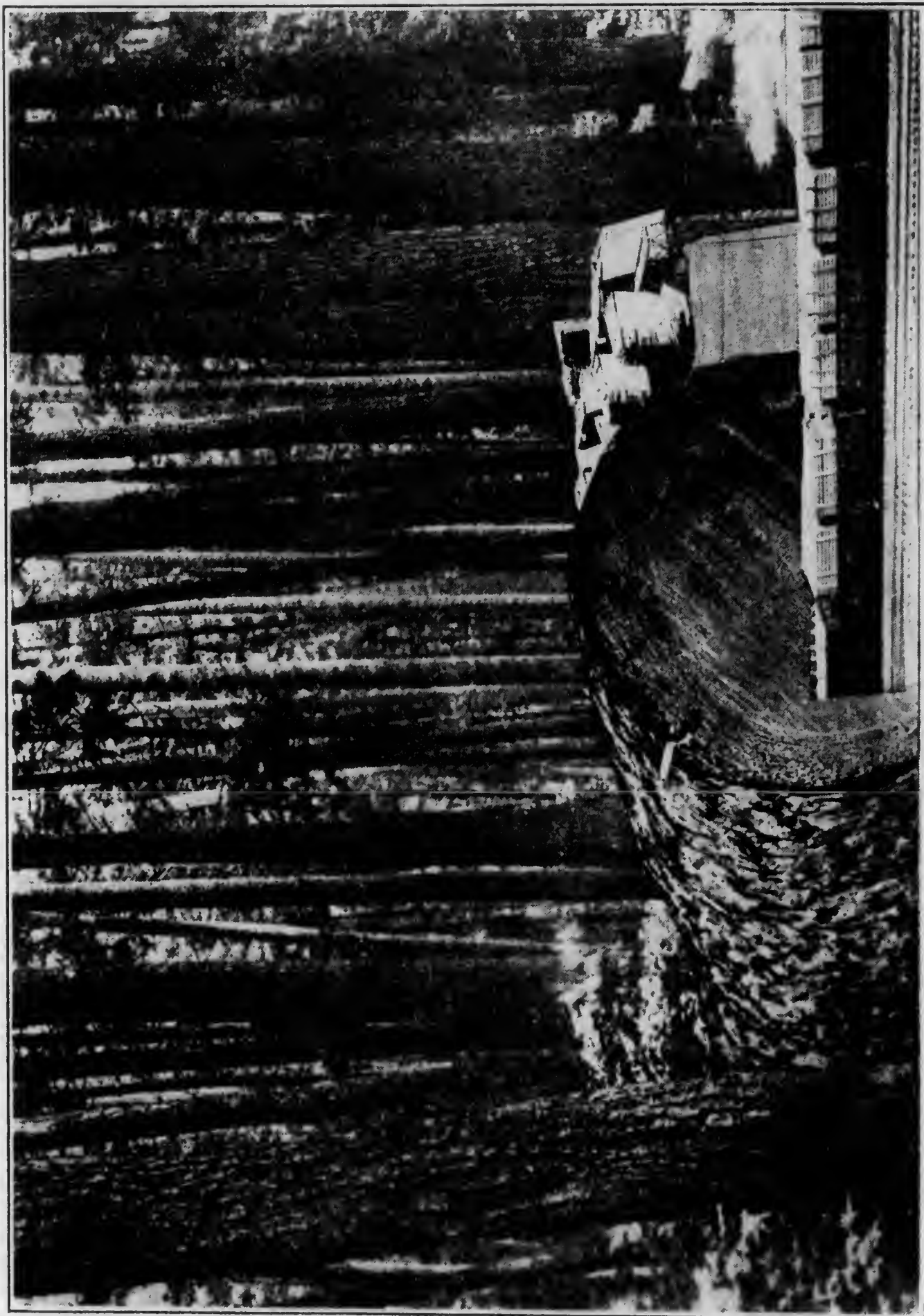
DECEMBER 6 and 7, 1927

Bulletin 45

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

Charles E. Dorworth, Secretary
Joseph S. Illick, State Forester

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GROWING FORESTS MEAN WOOD PRODUCTS AND FREIGHT REVENUE

PROCEEDINGS OF
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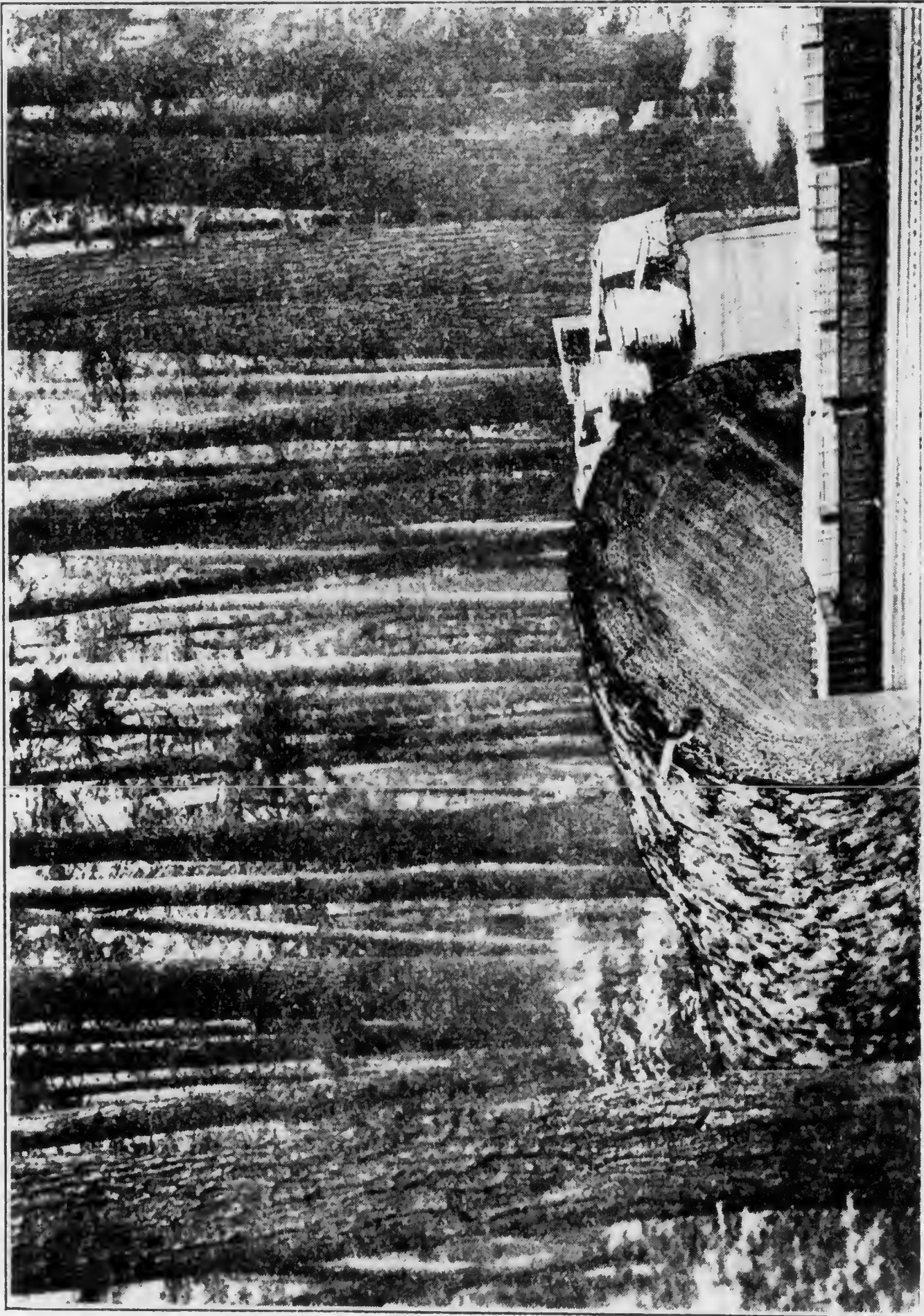
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CONFERENCE

Harrisburg, Pa.

DECEMBER 6 and 7, 1927

Bulletin 45

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF FORESTS AND WATERS

Charles E. Dorworth, Secretary
Joseph S. Illick, State Forester

INTENTIONAL SECOND EXPOSURE

**REGISTER OF RAILWAY AND FORESTRY REPRESENTA-
TIVES ATTENDING RAILROAD FOREST PROTECTION
CONFERENCE, STATE CAPITOL BUILDING,
HARRISBURG, PA., DEC. 6-7, 1927**

Name	Representing	Address
Ablett, John R.	Industrial Agent, Del. & Hudson Co.	Albany, N. Y.
Anwyll, H. L.	Dist. Freight Agent, P. R. R.	Harrisburg, Pa.
Bahr, Carl	Economist, Nat. Lumber Mfg. Assn.	Washington, D. C.
Bailey, Edward	President, Wmsport & N. Branch R. R.	Harrisburg, Pa.
Bates, Geo. E.	Asst. to V. P. for Industrial Develop- ment, Del. & Hudson Co.	Albany, N. Y.
Becker, Wm. J.	Div. Freight Agent, Erie Railroad	Scranton, Pa.
Biltz, F. W.	Supervisor of Track, Reading Co.	Pottsville, Pa.
Bishop, L. L.	Forest Supervisor, U. S. Forest Service	Warren, Pa.
Bitler, F. L.	Recording Sec. Penna. Forestry Assn.	Philadelphia, Pa.
Bridges, R. O.	Systems Engr. Hunt. & Broad Top Mt. R. R.	Huntingdon, Pa.
Briggs, Z. M.	Asst. Engr., P. R. R.	Pittsburgh, Pa.
Brooks, Donald P.	Gen. Land & Timber Supt. Central Pa. Lumber Company	Williamsport, Pa.
Byrne, Wm. M.	Asst. in Rwy. Fire Prevention, Forestry Dept.	St. Paul, Minn.
Chilcote, L. K.	Supt. E. Broad Top R. R. & Coal Co.	Orbisonia, Pa.
Clarke, H. S.	Engr. Maint. Del. & Hudson Co.	Albany, N. Y.
Clepper, H. E.	Asst. Dist. Forester, Dept. Forests and Waters	Pottsville, Pa.
Colbert, J. T.	Gen. Supt. Pittsburgh & Shawmut R. R.	Kittanning, Pa.
Cook, C. C.	Maint. Engr. Baltimore & Ohio R. R. Co.	Baltimore, Md.
Cromwell, O. C.	Asst. to Chief Motive Power & Equip- ment, Baltimore & Ohio R. R. Co.	Baltimore, Md.
Curry John R.	Asst. Forester, Md. Forestry Dept.	Baltimore, Md.
Dorworth, Hon. Charles E.	Secretary, Dept. Forests & Waters	Harrisburg, Pa.
Doughty, M. H.	Del. Lackawanna & Western R. R.	Hoboken, N. J.
Emerick, R. Lynn	Chief, Bureau of Information, Dept. Forests & Waters	Harrisburg, Pa.
Emery, Wm.	President, Dents Run R. R.	Williamsport, Pa.
Ferguson, J. A.	Prof. of Forestry, State College	State College, Pa.
Friend, G. H.	Special Asst. to Chief Engr., Western Maryland R. R.	Baltimore, Md.
Gochmour, Jr. Jos. P.	Gen. Mgr., Ligonier Valley R. R.	Ligonier, Pa.
Goodfellow, F. A.	Foreman, P. R. R.	Altoona, Pa.
Graff, F. M.	Supt. Production, Mechanical Dept., Erie Railroad	Meadville, Pa.
Hartenstien, Fred	Asst. to Gen. Mgr., Lehigh Valley R. R.	Bethlehem, Pa.
Heathman, H. R.	Forestry Engr. Bethlehem Mines Corp.	Johnstown, Pa.
Hoffman, J. M.	Chief, Bureau of Parks, Dept. of Forests & Waters	Harrisburg, Pa.
Hoyt, H. B.	Supt. Timber Preserving Plant, Buffalo, Rochester & Pittsburgh R. R.	Bradford, Pa.
Hutchison, P. L.	Attorney, Dept. Forests & Waters	Harrisburg, Pa.
Illick, Jos. S.	State Forester, Dept. of Forests & Waters	Harrisburg, Pa.
Jones, H. L.	Asst. Dist. Claim Agent, P. R. R.	Harrisburg, Pa.
Jones, C. D.	V. P. & Gen. Mgr., E. Broad Top R. R. Co.	Philadelphia, Pa.
Keiser, C. B.	Supt. Motive Power, P. R. R.	Harrisburg, Pa.
Kilby, W. H.	Chief of Forest Protection, Canadian Na- tional Railways	Montreal, Canada
Knapp, E. R.	Chief Claim Agent, Erie Railroad, N. Y. S. & W. R. R. and W. B. & E. R. R.	New York City
Krell, F. C.	Forester, P. R. R.	Philadelphia, Pa.
Layng, F. R.	Asst. Chief Engr. Bessemer & L. Erie Railroad	Greenville, Pa.
Leavitt, Clyde	Chief Fire Inspector, Board of Railway Commissioners	Ottawa, Canada
Lefevre, D. Clarence	Supt. Dept. Farm & Forests, Clearfield Bituminous Coal Co.	Indiana, Pa.
Liversidge, Robert M.	Chief Clerk to Pur. Agent, L. & N. E. R. R.	Philadelphia, Pa.
Meek, Charles R.	Asst. to Chief Forest Fire Warden, Dept. Forests & Waters	Harrisburg, Pa.
Morrison, W. W.	Chief Engr., Pittsburgh & Shawmut R. R.	Kittanning, Pa.
Neubert, J. W.	Chief Engr. M. of W. New York Central Railroad	New York City
Neumiller, A. C.	Forester, Lehigh Coal & Nav. Co.	Lansford, Pa.
Oxholm, Axel H.	Director, Nat. Com. on Wood Utiliza- tion, Dept. of Commerce	Washington, D. C.
Parmelee, Julius H.	Director, Bureau of Rwy. Economics	Washington, D. C.
Peters, J. R.	Asst. to Supt. Insurance Dept., P. R. R.	Philadelphia, Pa.
Phillips, Henry B.	Asst. to Chief, Bureau of Information, Dept. Forests & Waters	Harrisburg, Pa.
Phillips, N. M.	Forest Inspector, Dept. Forests & Waters	Mt. Carmel, Pa.
Prizer, John R.	Asst. Engr. Maint. of Way, C. R. R. of N. J.	Mauch Chunk, Pa.

Name	Representing	Address
Ream, A. H.	Supt. M. P. & E. Pittsburgh & Shawmut Railroad	Brookville, Pa.
Schimmel, E. S.	Bridge Engr. L. & N. E. R. R.	Bethlehem, Pa.
Schram, I. H.	Engr. M. of W., Erie Railroad	Hornell, N. Y.
Schrenk, Hermann Von	Consulting Timber Engr. N. Y. C. Lines	St. Louis, Mo.
Seely, S. A.	Div. Engr., N. Y. C. R. R.	Jersey Shore, Pa.
Sloan, J. M.	Sec.-Treas., Anthracite Forest Prot. Association	Hazleton, Pa.
Smith, H. A.	Dist. Forester, Dept. Forests & Waters	Pottsville, Pa.
Stephenson, G. C.	Supt. Port Reading Creasoting Plant, Reading Company	Port Reading, N. J.
Stewart, Geo. H.	Supervisor, Track, P. R. R.	Philadelphia, Pa.
Straub, Elwood B. F.	Statistielan, Dept. Forests & Waters	Harrisburg, Pa.
Taber, W. S.	State Forester	Dover, Delaware
Tonkin, R. D.	Timber Dept., H. C. Frick Coke Co.	Leckrone, Pa.
Townsend, Delmar K.	Gen. Mgr., Winsport & N. Branch R. R.	Hughesville, Pa.
Warner, Paul T.	Adv. Mgr., Baldwin Locomotive Works	Philadelphia, Pa.
Warren, L. O.	Gen. Mgr., S. & N. Y. R. R.	Williamsport, Pa.
Wirt, George H.	Chief Forest Fire Warden, Dept. of Forests & Waters	Harrisburg, Pa.
Yohn, A. E.	Gen. Mgr., Hunt. & Broad Top Mt. R. R.	Huntingdon, Pa.

RAILROADS REPRESENTED

COMPANY	REPRESENTATIVES
1. Baltimore & Ohio Railroad Company, ...	C. C. Cook.
2. Bessemer & Lake Erie Railroad Company, ...	O. C. Cromwell.
3. Buffalo, Rochester & Pittsburgh Rwy. Co., ...	F. R. Layng.
4. Central Railroad of New Jersey, ...	H. B. Hoyt.
5. Delaware, Lackawanna & Western R. R. Co., ...	J. R. Prizer.
6. Delaware & Hudson Company, ...	M. H. Doughty.
7. Dents Run Railroad Company, ...	G. E. Bates.
8. East Broad Top Railroad & Coal Co., ...	H. S. Clarke.
9. Erie Railroad Company, ...	William Emery.
10. Huntingdon & Broad Top Mtn. R. R. & Coal Co., ...	L. K. Chilcote.
11. Lehigh & New England R. R. Company, ...	C. D. Jones.
12. Lehigh Valley R. R. Company, ...	W. J. Becker.
13. Ligonier Valley Railroad Company, ...	F. M. Graff.
14. New York Central Lines, ...	E. R. Knapp.
15. Pennsylvania Railroad Company, ...	I. H. Schram.
16. Pittsburgh & Shawmut Railroad Company, ...	R. D. Bridges.
17. Reading Company, ...	A. E. Yohn.
18. Susquehanna & New York R. R. Company }	R. M. Liversidge.
19. Tionesta Valley Railroad Company }	E. S. Schimmel.
20. Western Maryland Railway Company, ...	F. Hartenstein.
21. Williamsport & North Branch R. R. Co., ...	Jos. P. Gochnour, Jr.
22. Canadian National Railways, ...	J. V. Neubert.
	S. A. Seely.
	Hermann Von Schrenk
	H. L. Anwyll.
	Z. M. Briggs.
	F. A. Goodfellow.
	H. L. Jones.
	C. B. Keiser.
	F. C. Krell.
	J. R. Peters.
	Geo. H. Stewart.
	J. T. Colbert.
	W. W. Morrison.
	A. H. Ream.
	F. W. Biltz.
	G. C. Stephenson.
	L. C. Warren.
	G. H. Friend.
	Edward Bailly.
	D. K. Townsend.
	W. H. Kilby.

PROGRAM

Tuesday, December 6

Afternoon Meeting, 2:30 P. M.

Opening Address

Chas. E. Dorworth, Secretary, Dept. Forests and Waters.

Timber Requirements of Railroads in Pennsylvania.

Dr. Julius H. Parmelee, Director, Bureau of Railway Economics, Washington, D. C.

Source of Railway Timber Supply and Cost of Importation to Pennsylvania.

Carl W. Bahr, National Lumber Manufacturers' Association, Washington, D. C.

Reduction of Timber Replacement by Preservative Processes, Salvage and Substitutes.

Dr. Axel H. Oxholm, Director, National Committee on Wood Utilization, U. S. Dept. of Commerce, Washington, D. C.

Evening Meeting, 8 P. M.

Railroad Interests in the Development of the Forest as a nearby Source of Tie and Car Timber.

O. C. Cromwell, Assistant to Chief of Motive Power and Equipment, Baltimore & Ohio Railroad Co., Baltimore, Md.

Freight Rates on Forest Products and the Effect on Local Forest Development.

R. D. Tonkin, Forester, H. C. Frick Coke Company, Pittsburgh, Pa.

Forest Fires and Their Causes in Pennsylvania.

George H. Wirt, Chief Forest Fire Warden, Department of Forests and Waters, Harrisburg, Pa.

A Railroad Forest Fire Prevention Program.

F. C. Krell, Forester, and J. R. Peters, Supt. of Insurance Dept. Pennsylvania Railroad Co., Philadelphia.

Motive Power Equipment for Fire Prevention.

Paul T. Warner, Advertising Manager, Baldwin Locomotive Works, Philadelphia, Pa.

The Value of Engine Inspections for Fire Prevention.

William M. Byrne, State Railway Inspector, St. Paul, Minnesota.

Wednesday, December 7

Morning Meeting, 10 A. M.

Maintenance of Way Activities for Forest Fire Prevention.

H. B. Hoyt, Supt. Timber Preserving Plant, Buffalo, Rochester and Pittsburgh R. R., Bradford, Pa.

Address

Hon. John S. Fisher, Governor of the Commonwealth.

Safety Strips for Forest Fire Prevention, Methods and Cost.

F. Hartenstein, Asst. to Gen. Mgr., Lehigh Valley Railroad Co., Bethlehem, Pa.

Cooperation between Railroads and Adjoining Property Owners for Forest Fire Prevention.

C. C. Cook, Maintenance Engineer, Baltimore & Ohio R. R., Baltimore, Md.

Forest Fire Patrol.

W. R. Lawrie, Duluth & Iron Range Railroad Co., Duluth, Minn.

Railroad Methods for Promptly Reporting Fires along Rights-of-way.

I. H. Schram, Engineer Maintenance of Way, Erie Railroad Co., Hornell, N. Y.

The Section Foreman as a Special Forest Fire Warden.

J. R. Prizer, Assistant Engineer, Maintenance of Way, Central R. R. of New Jersey, Mauch Chunk, Pa.

Afternoon Meeting, 2 P. M.

Forest Protection from a Railroad Standpoint.

M. H. Doughty, Division Engineer, Delaware, Lackawanna & Western Railroad.

Some Aspects of Railway Fire Prevention in Canada.

Clyde Leavitt, Chief Fire Inspector, Board of Railway Commissioners for Canada, Ottawa, Canada.

Forest Fire Education by Railroads.

W. H. Kilby, Chief of Forest Protection, Canadian National Railways, Montreal, Quebec, Canada.

State Regulations for Forest Fire Prevention.

(a) Representative of New York Central Lines. (b) Chief Engineer of New York Public Service Commission.

How Can Indifferent Railroad Organizations be Brought to Establish a Forest Fire Prevention Program?

G. H. Friend, Special Assistant to Chief Engineer, Western Maryland Railway Co., Baltimore, Md.

MINUTES OF PROCEEDINGS

TUESDAY AFTERNOON SESSION

December 6, 1927

The opening session of the Railroad Forest Protection Conference convened at two-thirty o'clock in the Senate Caucus Room, Capitol Building, Harrisburg, Pennsylvania, the Honorable Charles E. Dornworth, Secretary, Department of Forests and Waters, presiding.

CHAIRMAN DORWORTH: In calling this Conference to order I feel that it is a personal obligation upon me as Secretary of the Department of Forests and Waters to convey not only the Department's appreciation, but also the appreciation of the Commonwealth to you gentlemen for coming here on this mission.

The one note of regret that I have today is the unavoidable absence of Governor Fisher, who had planned weeks ago to be present this afternoon and personally greet you. He has been called to Washington but assures me that he will return in time to greet you tomorrow afternoon. I know that you will welcome his coming and that he will be delighted to see all of you.

I have a few remarks to make, from the Department's standpoint, before calling upon the speakers scheduled for the afternoon session.

The Department of Forests and Waters is charged with prevention and extinction of forest fires, because protected forests are a recognized economic necessity in Pennsylvania. We are convinced, and it is being demonstrated, that prevention measures are more satisfactory and cheaper for all concerned than an extinction program alone not only with the actual expenditure for fire control but with the attendant damages.

It is self-evident that a young forest burned is a forest prevented from reaching maturity.

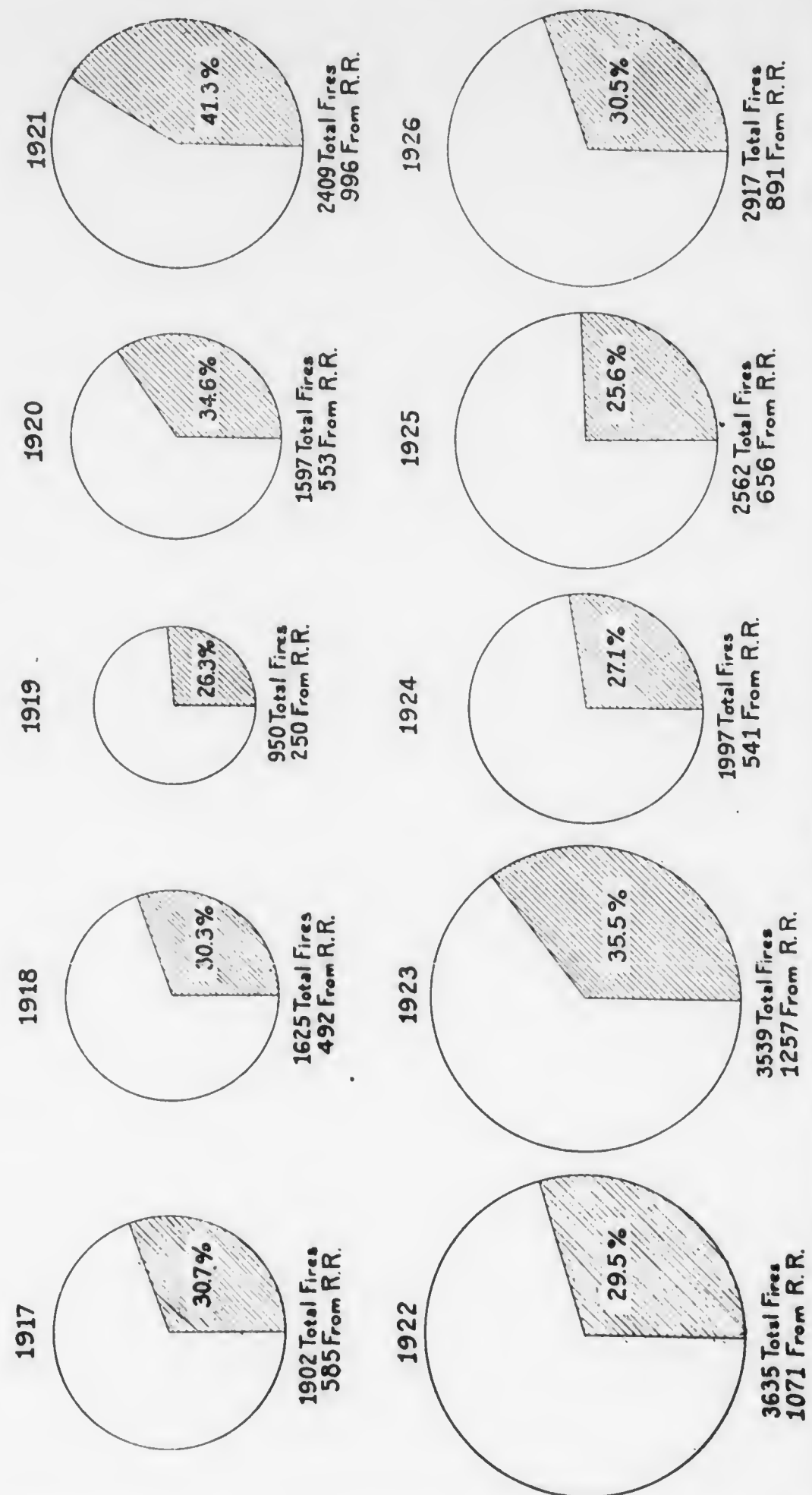
It is likewise evident that wood products are essential to railroads for use and for revenue producing freight.

Steam railroads operating within the State are responsible for more forest fires than any other one known cause, averaging from 30% to 35% of the total number, area burned, damage, and cost of extinction to the Commonwealth. Your attention is called to the charts about the room.

It must be recognized that the railroads of our country are facing an irresistible economic law in this forest problem.

PERCENTAGE OF FOREST FIRES CAUSED BY RAILROADS

1917 - 1926



Everybody uses wood. The more we use the more must be grown and the more transported. This, in itself, develops the question: Why not take advantage of this situation and make the most of it?

Burning up privately owned woods along rights-of-way is not only killing forests, but also killing railroad business. Such a policy arouses adverse public sentiment. It tends to undo the very things your departments of public relations are trying to accomplish.

The Department is warranted, therefore, in trying to bring about the correction of this large source of trouble and loss to the citizens of the Commonwealth. It can and will be done most effectively by sincere, sympathetic co-operation between the Department and the railroads.

Many railroad officials are, and all ought to be, foremost in giving and demanding forest protection instead of some being coaxed or forced to lend co-operation. For a number of years many railroad officials have indicated a desire to cooperate closely with this Department, but notwithstanding this attitude and the actual work done, railroad fires are not noticeably decreasing. The Department is not discouraged, for examples are on record of railroad divisions changing from an almost constant source of danger to an almost fire-proof proposition.

The Department believes in co-operation. We know from experience that where real co-operation is worked out, results can be accomplished, but co-operation must be based on mutual understanding. There must be an understanding with respect to the importance of the thing to be done and a mutual forbearance of the handicaps on both sides. Nevertheless, the vast interests at stake, plus the spirit of fair play, demand that the party who will not or does not want to learn, who can not see his own or his neighbor's welfare, and who will not co-operate, must be brought into line by force of public opinion or by regulation.

Regulation is distasteful. Nobody wants it. A frank discussion of the subject should result in a better understanding of the problem both from the viewpoint of the railroad man and that of the State official. This conference was called therefore to have railroad men strengthen their own position on forest protection and that the Department might continue to look forward hopefully to the complete elimination of railroad fires. Railroads are interested in having farmers raise more wheat per acre. Why not more ties to the acre?

In pointing out that the railroads have not accomplished all that is properly desired, the Department is conscious that we, too, are not perfect. We appreciate what has been done, and hope for still better things in the years to come. We trust, therefore, that within the available time there will be a free and friendly discussion upon any subject presented to the conference. We have invited to join

us in the conference not only representatives of railroads operating in Pennsylvania, but several representatives of other railroads who have accomplished noteworthy results in forest protection. We also have representatives of governmental boards having to do with railroads in their relation to forests. And in order that we might all be made acquainted with the real facts concerning railroad use of timber in Pennsylvania we have asked three national organizations to be represented. It is not only a great privilege, but a great honor, to have with us such men as Dr. Parmelee, of the Bureau of Railway Economics, Dr. Oxholm, of the United States Department of Commerce, and Mr. Carl Bahr, of the National Lumber Manufacturers' Association. (Applause)

Doctor Julius H. Parmelee is the first speaker of the afternoon, and will talk to you on "Timber Requirements of Railroads in Pennsylvania."

Before I ask him to come forward I want to suggest, in fact request, that there be a free, frank discussion of every subject presented.

It is a very great pleasure to me to present to you Doctor Parmelee, Director, Bureau of Railway Economics, Washington, D. C. (Applause)

DR. JULIUS H. PARMELEE: Mr. Chairman and Gentlemen: It is not only a pleasure to be here at this Forest Protection Conference, but also I consider it a great honor and privilege.

Of course, in discussing any problem such as this, the first step is to discuss the extent of the problem and the facts which underlie it, and I assume your Honorable Chairman has placed my paper first on the program because it is an attempt to contribute something to the facts of the problem. As to the policies involved, as to the methods of meeting the problems which you have, that rests with you, gentlemen, but if I am able to contribute anything to a statement of the facts I shall consider that my contribution has been worthy of your time and your attention.

Railroads in Pennsylvania and the other States of the Union use wood for a number and variety of things, ranging from bridge timbers to toothpicks. They are the direct purchasers of 17.5 per cent of the annual lumber cut of the country, and the indirect purchasers of probably as much as 7.5 per cent. Railway utilization of lumber and lumber products approximates 10 billion board measure feet of lumber each year. When that statement was first made to me I felt that it could not be possible, but after looking into the facts somewhat it appears that it was.

I shall develop in this paper the fact that the railroads in Pennsylvania, and for their use in the State of Pennsylvania, purchase annually from 450,000,000 to 500,000,000 board feet of lumber, and I

understand that the total production of lumber in the State of Pennsylvania ranges from 300,000,000 to 350,000,000 board feet per year.

Pennsylvania's railroads therefore require more than the annual production of wood products within her borders. This state has therefore a particular interest in problems both of forest production and of railroad utilization. While board feet measures convey some idea of the amount of wood products used, perhaps the best way to obtain a definite idea of the number and variety of wood articles required by railroads is to read the latest "Standard Material Classification" of the Purchases and Stores Division of the American Railway Association, which was compiled primarily in the interests of the uniformity in ordering the great variety of items used by railroads.

In this classification the complete range from bridge timbers to toothpicks can be followed, bridge timbers being found in Class 4, "Lumber, bridge and building," and toothpicks in Class 41, "Commissary Supplies for Dining Cars and Restaurants." Class 4 also includes piling, posts, bridge ties, wooden shingles, and manufactured lumber for bridges and buildings, the whole class consisting of 43 items altogether, with such apparently unrelated items as "Windows, ticket" and "Wings, cattle guard," at the end of the alphabetically arranged list.

Railways of Class I in the State of Pennsylvania purchase over a million dollars worth of switch and bridge ties alone each year, and switch ties bring us to the next class containing wood items, namely Class 5. This is divided into three subdivisions: Class 5 A, Switch ties, treated or untreated; Class 5 B, Cross ties, treated; and Class 5 C, Cross ties, untreated.

Class I roads in the State of Pennsylvania purchase annually (three-year average 1924-1926) nearly \$7,000,000 worth of cross ties, which is 6.6 per cent of the total purchases of cross ties for the United States.

I would like to pause at this point and say that the figures that I shall give you as I go along, as annual purchases, or annual consumption, are figures which are based on a three year average, the years 1924, and 1925 and 1926, and they relate only to the so-called Class I railroads, that is, railways that take in a million dollars or more in annual revenues. They do not include all the railways and it may be that my figures may differ somewhat from those which some of you may have in mind, or which others present to you, which may relate to the year 1926 alone and which may include the short lines of the State.

Cross ties are so large an item of expenditure that many persons, who are not familiar with railroading in its widest aspect, or who have no access to the Standard Material Classification, have come to

the conclusion that they are all the wood products that railroads purchase. They have indeed been a major item, and, with bridge timbers, they have been one of the items through which the railroads have made important contributions to the art of wood preservation and wood conservation, ever since the year 1848, when experiments were made with kyanized ties on the Northern Central Railroad of Maryland, now a part of the Pennsylvania Railroad System.

Pennsylvania railroads at the present time are using increasing numbers of treated ties, though the kyanized process has given way in large degree to more effective methods of wood preservation. The Pennsylvania Railroad, which renewed 207 ties per mile of trackage during the year 1925, used 90 per cent of treated ties as compared with 80 per cent in 1924, 74 per cent in 1923, and 68 per cent in 1922. The Delaware, Lackawanna and Western reported a renewal of 98 ties per mile of trackage in 1925, of which 91 per cent were treated as compared with 81 per cent in 1922. The Lehigh Valley shows an increase in the use of the treated tie from 79 per cent in 1922 to 95 per cent in 1925. The Central Railroad of New Jersey reported a 100 per cent use of treated ties in 1925, compared with 98 per cent four years previous.

The Pennsylvania Railroad reports that 50 per cent of all the ties in its tracks are treated, the Delaware, Lackawanna and Western 85 per cent, the Lehigh Valley 72 per cent, and the Central Railroad of New Jersey 79 per cent.

This progressive policy has reduced the annual tie purchases of the railways by 30 per cent during the past ten years. When the full effect of the present trend toward the use of treated timbers is realized—say within the next five to ten years—a further reduction of 25 per cent under the present requirements may perhaps be effected.

These facts explain why the railroad stores departments must have on hand "Chemicals for timber treatment", their Class 10 of the Standard Material Classification.

Going on with our investigation of the variety of wood products used on railroads, we come to Class 30, "Lumber, locomotive and car, rough and finished, including manufactured articles" consisting of 37 separate items, beginning with "Beams, brake (wood)" and ending with "Windows, complete, for coaches."

Many of the railroads of Pennsylvania have marine departments, so that we can include in their requirements Class 35, "Floating equipment material"; also such articles of wood as "Boats, ferry" and "Boats, life," "Lumber special to floating equipment," "Oars", and "Spikes, hickory."

Class 36 A, "Locomotive, Train and Station Supplies" includes "Barrows, wheel" and "Boards, bread", "Boards, meat", "Cases,

filing," "Chairs, office" and furniture of different kinds, "Cupboards" and "Drawers, money."

"Sawdust" in Class 38, ice house supplies, is another wood product that few persons offhand think of in connection with railroads, while any idea that the only large railroad burning wood for fuel of any kind is the Kenya & Uganda in South Africa is upset by "Wood, for locomotives" in Class 39, "Fuel, locomotive" and "Wood, for stations" in Class 40, and "Fuel for stations, ferries and power plants."

Class 41 contains "toothpicks" and presumably also the planks used for cooking steaks and fish so important in the dining car kitchens. Many other classes listing items of hardware and hand and small machine tools also include articles made of wood or containing wooden parts.

All of this demonstrates that the 300 million dollars that railroads of the United States spend for wood products, which amounts to approximately five per cent of their total operating revenues, is distributed among many items. Both the amount of money that is spent and the variety of articles purchased necessitate careful study of wood articles that are the products of our forests. Railroads in Pennsylvania, which include some of the largest in the country, requiring timber, and ties, and lumber for car and building construction in great quantities, have always been leaders in measures looking towards conservation and economy of use.

The most prominent feature of the railroads' contribution to the forestry movement lies in their program of wood preservation by creosote treatment. The roads were first attracted to this program when timber saving was not so much a factor of supply, but more a matter of reducing maintenance expenses. As timber has become more and more scarce, and as the source of supply has changed from a local to a national problem, the practice has become closely identified with conservation.

The railroads have always been the greatest users of treated wood in this country. The Forest Service of the Department of Agriculture reports that 65 per cent of all wood reported treated during 1926 consisted of cross ties, and states that "the bulk of wood treated has consisted of crossties, supplemented by large quantities of timber in the form of switch ties, construction timber, crossing plank, tie plugs, car material and similar products essential to the successful and continued operation of the rail transportation system of the country".

This practice has accomplished much in reducing the annual drain upon our forests, and is of particular significance to the State of Pennsylvania, because of the fact already stated, that the annual lumber requirements of the railroads of this state are greater than the total annual production within the borders of the state.

The great lumber consuming centers of the east have come to depend more and more on the production of the North Pacific and Southern Pine regions. The so-called industrial group of states,—i. e., those 16 states and the District of Columbia comprising the group lying north of the Potomac and Ohio Rivers and east of the Mississippi River—produce only 25 per cent of their annual needs. The State of Pennsylvania, which ranks third among the states in annual lumber consumption, produces only 16 per cent of its needs. It follows, then, that the railways of this section, and of this state in particular, have a deep interest in all conservation and reforestation plans instituted in this area.

The Class I railways of the United States in the past three years (1924 and 1926, inclusive) have purchased annually an average of 93,284,810 cross ties or an equivalent of about 3.7 billion board measure feet. The cost of these purchases averaged \$102,689,912 per year and represented 57.3 per cent of the average expenditure for all forest products.

The annual purchase of cross ties for use on Class I lines within the State of Pennsylvania is estimated at 4,881,000, or 5.2 per cent of the total for the United States. The annual cost is estimated at \$6,766,000.

Great strides have been made in the past 25 years in the economical use of cross ties. A survey of the renewals of 25 of the large railways for the past 25 years, as reported by the American Wood Preservers Association, indicates that whereas these roads renewed 264 ties per mile of track in 1900, by 1925 this figure had been reduced to 187 or a reduction of 29.2 per cent. This is the direct result of the more extensive use of treated ties and to greater care in selecting, transporting and placing them.

The Class I Railways of the United States purchased in the past three years an average of 333,813,000 board measure feet of switch and bridge ties per year at an annual cost of \$12,685,199.

The purchase of these ties for use on Class I lines within the State of Pennsylvania is estimated at 30,244,000 board measure feet per year, at a cost of \$1,337,825. This represents 9.1 per cent of the total Class I footage, and 10.5 per cent of the total cost.

As with cross ties, the railways are finding it more and more expedient to treat their switch and bridge ties, and the increasing use of this process has greatly reduced the annual needs.

The American Railway Engineering Association has rendered valuable service in promoting the efficient use of cross, switch and bridge ties. By specifying the standards to which each type of tie must conform, much waste has been eliminated.

The Class I railways purchased an average of 1,431,103,000 board measure feet of timber and lumber in the past three years at an an-

nual cost of \$55,598,200. This represented 31 per cent of the total expenditures for forest products.

The Class I lines in Pennsylvania purchase an estimated 95,708,000 board measure feet per year at a cost of \$4,421,000. This was 6.7 per cent of the quantity and 8.0 per cent of the cost of all Class I roads.

I might say¹ that the words "timber" and "lumber" used in this case represent bridge and building timber, piling posts, wooden shingles, and manufactured lumber for bridges and buildings; lumber, locomotive and car, rough and finished, including manufactured articles; grain doors, grain and coal door lumber, and cooping material for grain and flour cars.

A considerable reduction in this item has occurred during the past decade, due mainly to the greater use of building substitutes, treating of poles and piles, and to more efficient methods of operation.

The general class known as "Other Forest Products" includes the many miscellaneous items that the railway use other than those considered above. Such items as scrap, foundry supplies, and material in the process of manufacture come under this heading.

These purchases cost the Class I roads an average of \$8,216,111 per year, in the last three years. The Class I lines in Pennsylvania average 3.7 per cent of this item.

Combining the various general classes already mentioned—cross ties, switch and bridge ties, timber and lumber, and "other" forest products—it is estimated that the Class I carriers of the State of Pennsylvania accounted for about one-fourteenth of the total purchases of all Class I lines in the United States. These purchases are distributed as follows:

	<i>B. M. feet</i>	<i>Value</i>
Cross Ties, ...	195,235,000	\$ 6,766,000
Switch & Bridge Ties, ...	30,244,000	1,338,000
Timber & Lumber, ...	95,708,000	4,421,000
Other forest products ...	8,813,000	306,000
	330,000,000	\$12,831,000

These are direct purchases. Including indirect purchases, that is, the lumber which the railroads buy indirectly when they buy a car or a locomotive or equipment made by some other firm but into which lumber enters as a part, the totals approximate from 450 to 500 million board measure feet, at a total cost of some 18 or 19 millions of dollars.

In closing this brief survey, a few statistical comparisons may be of interest. The annual direct and indirect lumber requirements of all steam railroads of the United States, in board measure feet, would cover the combined area of the states of Rhode Island and Delaware, if spread out in the form of one inch planks.

Direct lumber purchases by the Class I railways of the United States for 1926 were sufficient to put a roof over the city of Chicago.

The estimated annual lumber requirements of the Class I lines in Pennsylvania would more than roof the city of Reading.

The number of ties consumed annually in the State of Pennsylvania would, if placed end on end, reach a distance of 6,933 miles, or more than one-quarter of the distance around the world, while the annual tie consumption of all railways in the United States would encircle the globe 5 times.

These are just a few of those statistics that we hear so much about to give you a picture of the variety of the things that a railroad buys. The statistics relating to board measure feet and cost and these others are simply thrown in to get a visualized picture, if possible, to see the extent to which the railroads of this state are buying and using lumber each year.

The forested country through which Red Jacket roamed has changed, even though Kipling wrote not so very long ago that the pleasant woods of Pennsylvania were unaltered since that Indian Chief-tain assisted General Washington in so many ways. Even so have the Conestoga wagons given place to freight trains, in the march of transportation progress, while Pennsylvania along with the other states north of the Potomac and Ohio and east of the Mississippi have become the great industrial states of the Union, with the inevitable result that the forests have been lessened in area.

However, the railroads of Pennsylvania, among the largest consumers of lumber in the industries, have found in the necessity for securing wood products, an opportunity for sustained conservation not only of local supplies, but of the products secured from forests in other sections.

I trust these very few statistics which I have presented to your Conference will help to state the problem, state something of the extent of the use of lumber by the railroads generally, and by the railroads of Pennsylvania particularly, and will form something of a basis for the discussion of your many problems.

Let me express again my appreciation for your invitation to be here and thank you for the attention you have given me.

CHAIRMAN DORWORTH: I am sure we have all enjoyed Doctor Parmelee's paper.

If there is anyone here who would like to take up some point, or ask some question, some elaboration of any point Doctor Parmelee has brought out, this would be the time to do it.

If not, we will now hear from Mr. Carl Bahr, Representative of the National Lumber Manufacturers Association, Washington, D. C., on the subject of "Source of Railway Timber Supply and Cost of

Importation to Pennsylvania." It is a great pleasure to introduce to you Mr. Bahr. (Applause).

MR. CARL BAHR: Mr. Chairman and Gentlemen: I think you will find my paper little more than an elaboration of Doctor Parmelee's remarks.

The railroads of the United States consume annually one-quarter of the total lumber cut of the country. More than one-sixth of the total production is purchased by the railroads directly, and is used by their own organizations. An additional amount, sufficient to bring the total up to twenty-five per cent, is used by construction companies and other contractors doing work for the railroads. It is evident, therefore, that the railroads have a vital interest in matters pertaining to forestry and timber supply.

The forest products requirements of the railroads, embracing a wide variety of uses, likewise require different classes of raw material as regards strength properties, size and form, quality, and durability. In order to meet these requirements they have been forced to go to distant forest regions, there to select not only the kinds of wood that are suitable but the best quality of material produced from these chosen species. When one considers that wood in one form or another is used for cross, switch and bridge ties, building construction, bridge and dock timbers, car construction, posts, poles, fences, water tanks, guard rails, crossing planks, and other purposes, the dependence of the railroads on the forest products industries is readily evident.

The railroads of Pennsylvania along with the other wood consuming industries of the state are able to satisfy only a minor portion of their timber requirements through local sources of supply. In 1918, according to the U. S. Forest Service, the State had a lumber cut of 530 million feet which was not sufficient to meet the needs of the Pittsburgh District alone. In 1924 Pennsylvania produced slightly more than 340 million feet while it consumed about six times that amount. The state ranked fourth in quantity consumed and 20th in amount produced. In 1926 the production was slightly less than 320 million board feet. Ninety per cent of its consumption originated without the state and had to be shipped in at an average freight rate of over \$12.00 per M feet or an actual charge of more than 22½ million dollars. The lumber originating and consumed within the state bore an average freight charge of \$5.67 per M feet or a total charge of \$1,280,000. The average freight charge on all lumber consumed in Pennsylvania was \$11.61 per thousand and aggregated \$23,847,000 for the year. On this basis the transportation costs on the 132 million feet of timber and lumber purchased in 1926 by the railroads of the state (both class I and shore line) amounted to over 1½ million dollars or 25 per cent of the total purchase cost. I might add

that in my tabulations I have considered both Class I and short line railroads. I think that Doctor Parmelee only took Class I roads. I also have used only the year 1926.

Of the forest products consumed by the railroads of Pennsylvania as lumber and timber very little originates within the state, and in the years of the near future the proportion so originating will be even smaller. Southern Pine and Douglas fir, the two most important structural species, of course, must be brought from distant regions by long boat or rail shipment. Although relatively small quantities of lumber for building purposes will continue to be produced within the state, and although more will be available from such local sources as forestry develops, much of it will be of relatively low quality and unsuited for many railroad uses. The centers of the producing regions of the ten states leading in the production of softwood lumber and representing four-fifths of the total cut of the country are from 1,000 to 3,000 miles distant by rail and up to 6,000 miles distant by water from the consuming centers of Pennsylvania. Although some of the local railroads operating in other states besides Pennsylvania are in a more advantageous situation as regards transportation costs on lumber products, nevertheless freight charges are an important item of expense when it is realized that they represent as much as 25 per cent of the total delivered cost of lumber. And there is little probability that nearer sources of supply for such material can be developed within fifty years through the practice of forestry. Softwood structural material, characterized by narrow annual growth rings and relatively large percentages of summerwood, the combination of which results in wood of the highest strength properties, is usually the product of virgin stands which have required at least a hundred years to mature. Under management Nature's leisurely process may be somewhat hastened. Second growth stands are usually of rapid growth and generally do not produce material of the highest structural properties by the time they are large enough for the saw. Furthermore, the long periods of time required to develop timber of structural sizes have so far made it economically impracticable for commercial interests to hold and manipulate cut-over land with the idea of growing material of this character. The public forests must be mainly looked to for aged trees in the distant future. The 80,000,000 acres of National Forests first and such State Forests as those of Pennsylvania, later must meet the demand. Much lumber for ordinary building purposes, however, is already being produced from second growth or cut-over land and the proportion so originating can be expected to increase steadily. We are making wonderful strides in reforestation of private lands. We have only started, and yet we have accomplished considerable. The private lands now under forestry

management in the United States are perhaps equal in area to the State of Maine. About two hundred large companies are on the list of reforesters.

From the standpoint of quantities involved cross ties are the most important of the forest products used by railroads. Unlike lumber and other sawmill products on which detailed species and regional production figures are compiled annually, very little specific information is available concerning the regional production of cross ties. Assuming that the various woods were used for cross ties in Pennsylvania in the same proportions as the purchase records show them to have been used in the eastern district, the 5,965,000 cross ties purchased annually would be divided approximately as follows:

<i>Species</i>	<i>Per Cent</i>
Oak (red and white), ...	61
Pine, ...	8
Chestnut, ...	6
Beech, ...	5
Cedar, ...	4
Maple, ...	4
Birch, ...	2
Gum, ...	2
Ash, ...	1
Miscellaneous, ...	7
	100

Large quantities of ties are produced by farmers and small operators scattered over the country. Although it is impossible to determine specifically the sources of ties produced from the woods mentioned, a general idea of those sources can be secured by considering the location of the commercial supplies of some of the more important of these species as estimated by the U. S. Forest Service. Over 40 per cent of the commercial stand of oak in the country is located in the Central states, more than 30 per cent in the lower Mississippi Valley, 18 per cent in the South Atlantic and East Gulf states and only about 3½ per cent in the Middle Atlantic states, including Pennsylvania.

The southern pine is divided almost equally between the lower Mississippi Valley and the South Atlantic and East Gulf regions. Chestnut, most of which has been killed by the blight, is distributed roughly as follows: 20 per cent in the Middle Atlantic states, 5 per cent in New England, and 75 per cent in the Central states and Southern Appalachian region. Of the stands of beech, birch, and maple, about 40 per cent is in the Lake states, 25 per cent in the

Central states, 20 per cent in the Middle Atlantic states, 10 per cent in New England, and the remainder scattered in relatively small quantities throughout the Southern states.

From the above it will be seen that Pennsylvania contains relatively small quantities of cross-tie supplies. It is true that cut-over lands can be expected to produce material suitable for ties in a much shorter time than high grade lumber. The many and large mines within the state, however, consume enormous quantities of timber, in forms and sizes that make it possible to cut trees for mine use even before they are of tie size. Also, mining interests in the state own considerable areas of forest land, which are used to supply their own needs, and thus restrict the local sources of supply for the railroads needs.

Several factors are tending to reduce the wood requirements of the railroads and to cut down the costs of such materials. The art of wood preservation has developed rapidly and has a very noticeable effect on the cross tie requirements. Service records show that there has been a gradual decrease in the renewals per mile during the last 20 years. The use of preservatives has also made possible the use of a number of woods—some of them of very rapid growth—which untreated are very susceptible to decay and therefore unsuitable for tie purposes. The increasing use of preservatives for the treatment of other railroad material is also growing, and the results of such applications will be shown through longer service and smaller actual quantity requirements per operating unit.

As regards timber and lumber requirements, proper selection of material suited to the particular purpose and standard grades and sizes, will make possible the use of all commercial woods available, and will result in efficient utilization of our present timber supply. That supply will hold out until managed forests succeed the natural forests. There may be a period in which wood will be more scarce and more costly than we would like, but that is the inevitable price of new forests. Every civilized nation has had to endure it. A Utopian communism might conceivably exercise prescience and say at the foundation of the nation that so much land should be reserved for forests, so much for agriculture, so much for cities and so on—and then plant trees as fast as they were cut. Under our economic system however, we have to leave the decision in such matters to time and the law of supply and demand. Given enough time we shall have as ample timber supplies as the nature of our land and its competitive uses will permit—if we are ready to pay the price. Inevitably that price must be higher than in the times when no timber growing costs were included in the price of lumber and other forest products. The wild forest cost nothing to grow. Manifestly it could not last forever. The new forest has to be paid for—and through the cost

of its products. Continue to use wood, and grow new forests! That is the much and little of the future of the wood supplies of the railroads of Pennsylvania, as it is of all other industries everywhere that use wood. (Applause)

CHAIRMAN DORWORTH: I am sure you have all enjoyed Mr. Bahr's paper. I know that he will be very happy to discuss, now or later, any point which anybody here wishes to bring up with him.

It is a very great pleasure to me to be able to ask you to listen today to Dr. Axel H. Oxholm, Director, National Committee on Wood Utilization, Washington, D. C., the Committee appointed by President Coolidge to effect a closer utilization of timber. Doctor Oxholm has conferred a very great kindness upon us in making his engagements so as to permit his being with us on this occasion. I am indeed very proud to have this opportunity of presenting him to this Conference. Doctor Oxholm! (Applause)

DR. AXEL H. OXHOLM: Mr. Chairman and Gentlemen: It is really a great pleasure to me to be here today because it gives me an opportunity of discussing a matter of very great importance to the railroads, namely, a closer utilization of our timber resources. The subject assigned to me may seem to be somewhat different, but in reality it is just in line with what my brief address is going to cover.

You all know that the industry connected with the exploitation of forests has been on the move ever since this country was settled. We have seen how the forests in the East have gradually disappeared and the lumber industry moved out to the Middle West, then down to the South, and now, finally, it has reached the Pacific Coast. We are just wondering how long these virgin timber supplies will last, and I am quite sure that there is more than one in the room that have wondered where in the world we are going to get our timber from in the future.

I happen to know that some of the companies whose representatives are here today have investigated the foreign field in order to find out whether we can get some of our supplies of forest products from abroad. Some went to Siberia, others went to Russia, some to South America, some to Australia and some to Central America, but I have reason to believe that they were all more or less disappointed. While those countries have very vast timber resources there are so many difficulties in the way of exploitation that we have come to the realization that we must depend on ourselves.

Now that may account for the fact that reforestation has received such an impetus during the last few years.

The railroads, using one-quarter of the lumber cut in the United States, as we have heard from the two previous speakers, naturally must take a keen interest in this question of future supplies.

Now then, when we look into the question of growing trees we find that we have better natural facilities than any other civilized country; we are growing a greater variety of species. In fact, we have somewhere between 850 and 900 different kinds of wood in the United States. Of these we have probably 100 or 150 species which are of commercial importance. Furthermore, we can grow, in twenty or thirty or forty years, what requires twice or three times the period in many other countries. Nevertheless, we are today importing forest products from some of those countries that require a hundred or more years for the growing of the trees to maturity.

We also have the largest market for forest products right at our own door-steps. Our producers of lumber, pulp or wood chemicals, do not have to cross any frontier, do not have to overcome customs barriers or other difficulties in the way of commerce which we find in most European countries.

Therefore, we find that we have the best facilities for tree growth and the best conditions for the marketing of our forest products. Why, then, is it that we have failed to take advantage of this position? That was the question, gentlemen, which came up in 1925 when President Coolidge called a conference in Washington, attended by over 500 timber land owners, manufacturers, distributors and consumers of forest products. The result of this conference was the establishment of the National Committee on Wood Utilization. Secretary Hoover is the man who organized it; he was also the one who was chosen to be the Committee's Chairman. We have, as Vice-Chairman of the Committee, Colonel William B. Greeley, Forester of the United States. The Committee is today composed of in the neighborhood of 140 leading men, representing the manufacturers, distributors and consumers of wood products, and I am very glad to say that Mr. Aishton, President of the American Railway Association, is one of our valued members. Another member is Mr. Cook, Maintenance Engineer of the B. & O., and Mr. John Foley, Assistant to the Purchasing Agent of the Pennsylvania Railroad.

Now this Committee found that the main stumbling block in the way of reforestation on a commercial scale was the defective utilization of our timber. Mr. Bahr, a minute ago, said that it is not possible for man to compete with nature. We received these virgin timber supplies for nothing, and naturally if you get a thing for nothing you don't appreciate it. That is the reason we have not utilized more than between one-third and one-half of the tree as it stands in the forest.

But, gentlemen, it isn't possible to raise forests in a commercial way on that basis. The timber land owner cannot hope to do that any more than the farmer can hope to sell his cattle at a profit if the packing house industry were only in position to utilize half of the

cow. Now the reason why we have established the meat packing industry on a firm basis is precisely this matter of close utilization, which, in that case, practically amounts to one hundred per cent.

It goes without saying that we cannot ever hope to have one hundred per cent utilization of wood simply for the reason that wood contains a considerable percentage of moisture that, of course, we can't do anything with. We also have bark, which is still a problem. Bark can be used for fuel but in most instances is at present incapable of further utilization.

Now the saw log, on the other hand, is suitable for 80 or 90 per cent use, but we are not putting it to that complete utilization—you all know that.

Now it might be your first impulse, as it is the impulse of most other people, to say that the matter of reforestation is up to the primary producer, the lumber producer. But we believe that this responsibility for reforestation rests with you, as consumers, more than with the primary producer, and I shall try to explain just how we have gone about this matter to come to that conclusion.

Let us, for a moment, consider what the railroads are using of forest products, and how they are using them. First of all lumber is the biggest item. It is the oldest industry and the largest of all forest industries. We produce in the neighborhood of 36,000,000,000 feet of lumber, corresponding to 52 per cent of the total output of the world. Now if the railroads are using between one-fifth and one-fourth of that output of lumber it must also be guilty of some of the wastes which occur in the consuming practices. Those of you who are familiar with saw mill practices know that one-fourth of the log must necessarily produce lumber in lengths of less than eight feet. You all know that logs have a tapered form, and naturally, in cutting up the logs, the outside boards, those close to the bark, must be shorter than those boards cut in the center of the log.

Now there we have a problem of short lengths. Similarly, lumber of long lengths contains defects. There may be a big knot or a check or something of that sort, and in order to increase the utility of that piece the lumber manufacturer must eliminate those defects. That naturally increases the production of short lengths. I mention that to show you that the production of short lengths is not a matter over which the lumber manufacturer has any control whatsoever.

Now, then, when it comes to disposing of these short lengths the lumberman is up against it. He finds that the railroads, as well as all the other consumers, are insistent on sixteen-foot lengths, to be cut up into two lengths of eight feet, or four lengths of four feet each—and you all know you are doing it. As a result short lengths, cannot be sold. In order to find out to what extent this practice was com-

mon we made an investigation of 250 house plans furnished by the Architects' Small House Bureau of Minneapolis. A sub-committee under the chairmanship of Mr. Foley of the Pennsylvania Railroad was organized for that purpose, and we found that twenty per cent of the lumber used for the construction of the small house was of the short length variety, but the contractors and the builders only purchased one and one-half per cent of short lengths. In other words, eighteen and one-half per cent of the total lumber going into these small houses was purchased in long lengths and cut short on the job.

Now, then, I am not going to ask any of you to look at this thing from the point of view of charity. We are not asking you to do anything just for the sake of helping the lumbermen to make more money. We are all in business for the sake of making a profit, but if I tell you that these short lengths can be purchased at a discount ranging from ten or fifteen, up to forty and forty-five per cent, at the mill, then the question might be interesting to you.

Not so very long ago I spent the day at the Frankfort Arsenal in Philadelphia, and I found that these people were buying 16 foot-lengths and cutting them up into box shooks all shorter than fifty to sixty inches. I called their attention to this and as a result the Secretary of War insisted on having a change made, not only at Frankfort Arsenal but also in Washington, and last week the revised specifications of the War Department went out calling for lumber in lengths of four feet and up, with a heavy percentage in short lengths. Now if the Government has found that this practice pays it must also apply to similar items in industry.

A good many of the railroads are using short lengths but the majority are not, at least not to the extent that they ought to.

Then you might say that the handling of short lengths would be perhaps a little harder in some instances, and I agree with you on that, but we are asking you if you haven't overlooked a very important source of revenue in the way of freight on these short lengths.

I am just briefly going to touch upon the minimum load required by the railroads, minimum load per car. A car is about from 38 to 40 feet long, I believe. Now supposing that you ship two 16 foot-lengths in that car. Then you would have a space right in the middle, behind the car door, of from 6 to 8 feet. Now, under present practices, that space remains vacant. There is no incentive for the lumber mill to load the car to capacity as long as the weight is above this minimum load; that is all he is after. On the other hand, if we could load up this car to full capacity with short lengths, then the railroads would increase their average carload—and there is a matter of immediate interest to you.

Then, to come back to the short lengths again. The Committee is taking up this question of making short lengths more useful to

consumers, and we are now pushing a project covering so-called "end-matched soft wood lumber." The matter is very simple. We take a piece of short length, provide one end with a tongue and the other with a groove, just as you have seen one or both edges of flooring. Now, taking these boards we can join two or more pieces into a continuous tape, if you will call it that. It can be applied in building and construction—no waste in cutting the lumber back to the joist of support. The pieces are strong enough so that the joints may even meet between joists or studs. Now there we have a means of reducing waste by about 12 per cent, because, regardless of length, it may be eight feet, one inch, or three feet, two inches—it makes no difference at all—you can use every piece of end matched lumber as it comes from the mill. Now I am mentioning that because this end-matched lumber also means that the lumber mill will be enabled to cut out serious defects which you are now receiving. These defects are left at the mill by this new procedure, and you will only get material one hundred per cent useful.

Furthermore, the installation cost is very much lower and any ordinary laborer can put down a floor of this end-matched material. You don't have to have skilled labor for that purpose.

The matter is exceedingly interesting, not only for the builders and contractors but also in industry, for car building and car repair work. We are looking into this thing; we are going to expand the uses for it and see what we can do, because we realize that by this end-matched process we are making lumber more useful to the consumer, and at the same time getting more out of the tree.

Let me briefly mention two other items. One is the odd width and the other the odd length. Do you gentlemen realize that we have soft woods in the United States that are costing far more, some of them, than some of the more expensive hard woods? I am referring particularly to white pine. Now it would make your heart ache if you had accompanied me on my trip up to Wisconsin and Minnesota and out into the West, and had seen how perfectly beautiful lumber thirteen inches in width has been edged down to twelve inches; how boards absolutely of perfect quality, of nineteen feet and ten or eleven inches in length have been cut down to eighteen feet, for no other reason in the world except that you, as consumers, insist on so-called "even lengths" and "even widths", such as six, eight, ten, twelve and fourteen inches in width and the same dimensions in feet in length. Now is there any reason in the world for that? We believe not, because we have investigated the matter and we find that our houses are not constructed on the basis of even width or even length dimensions. In fact, a close investigation which we made showed more that there is a forty-eight and one-half

per cent use of odd lengths. So the demand for odd lengths ought to be just about as good as the demand for even lengths.

Now in regard to width. I don't have to tell you anything about that because you know as well as I do that for covering purposes it makes no difference at all whether you have four, five-inch boards, or five, four-inch boards. There is no reason why there should be a jump from four to six inches. If you don't believe that just look at the practice in every foreign country except Canada. These dimensions have been used for centuries. In fact in France I found that they are buying our Southern Pine on the even length basis and selling it on the basis of multiples of four inches. And they use lumber over there for the same purposes that we do; there is not a great deal of difference in their wood using practices and our methods.

Now I have mentioned the question of short lengths, end-matched lumber, odd lengths and odd widths, because if we could find a market for these dimensions it would mean that we would raise the utilization of the log from thirty to fifty per cent. Now that would mean, gentlemen, that we would be on the same basis of utilization as many of the advanced foreign countries.

What effect would that have on the value of stumpage? It would mean that this tree over here now selling on the basis of \$3.50 per thousand feet, current value of stumpage in the Douglas Fir country, would be worth \$7.00 or even more, because instead of getting twenty or thirty board feet of lumber under present utilization conditions, we would get thirty or forty or fifty feet, and with less effort and expense. Our logging could be concentrated on a smaller area and expenses would be reduced accordingly.

Is it not peculiar to note that lumber from the north European countries right now is coming into the Eastern Coast of the United States by the millions of feet? There was one cargo in Providence which was unloaded not so long ago, of 3,000,000 feet, cut, as I understand it, on the odd and even feet and odd and even inches. I understand that some of the railroads are using this material and finding no objection to it at all, but if a domestic concern puts up this proposition to you, you will very likely object.

Now those people have a stumpage fully 100 per cent higher than we have in this Country. You will be surprised to hear that the labor charges in Sweden are fully 35 per cent higher than the labor charges south of the Mason-Dixon Line. They have eight hours—we have ten. So they have no advantage at all except this matter of closer utilization.

Now since we have talked about lumber for a while let us consider a few of the by-products; and that is a very important thing

because the railroads would be able to increase their profits from the hauling of more freight. You all realize the importance of the hauling of lumber to the railroads. If the figures are correct I understand that half a billion dollars alone accrues annually to the railroads from the hauling of lumber.

Now in this state you have a very important industry, namely, the wood chemical industry. You also have a pulp and paper industry. You may have a number of other so-called by-products industries, using wood in one form or another as raw material. But do you find that these industries are coordinated as far as the raw material policy is concerned? We have not found it to be so except in a few isolated cases. By that I mean that the lumberman, naturally, needed the best class of logs—you might say the cream of the forest. He is dependent on a certain length and width and quality. On the other hand the pulp producer would take what the lumberman can't use, top logs, edgings and mill lengths, and material of that sort. He does not need 16-foot logs because he takes his wood, reduces it to chips and grinds it or reduces it by chemicals into pulp for the manufacture of paper. The wood chemical producer can even go one step further. He does not need, strictly speaking, sound wood. He can very well use certain quantities of partly decayed wood, or certain species unsuitable at the present time for pulp and paper purposes.

Now would it not seem perfectly logical that these industries be coordinated so that the lumberman would get his first, then he would turn what you might call waste—and we prefer to call non-utilized material—over to the pulp man, and he would turn what he couldn't use over to the wood chemical man, and in that way build up a series of correlated by-product industries, with the saw mill as the center.

Now that is exactly the way forest industries have been organized in the most progressive foreign countries, those countries that are sending us not only lumber but pulp and paper chemicals and what-not. That is the only way these countries can exist today on account of the competition.

That is, gentlemen, the only solution that we can see of the forest industries in this country in the future.

Now you would be surprised to hear about sawdust. Doctor Parmelee mentioned the fact that the railroads are using sawdust. Why don't everyone of you be good enough to go back to your office and ask whether that sawdust is American or imported sawdust—and you will all laugh at the idea of imported sawdust—we have sawdust to burn to say the least. It is a matter of fact that we imported between six and eight thousand tons of sawdust from Europe and other countries last year in the form of wood flour. That is nothing but

sawdust ground on the old-fashioned burrmill used for grinding grain.

That is what we imported from countries like Holland, which imports 93 per cent of its wood requirements, and after cutting the logs into lumber and using the lumber for various requirements, scoops up the sawdust and sends it back to the United States and gets \$30 a ton for it.

Now it seems to me, if you gentlemen are interested in the building up of these forest resources, not only for the sake of doing something of national importance but also to create some freight revenue for yourselves, and secure the necessary supplies in the future for your own use, then you ought to give preference to domestic sources of supply.

I may mention that two weeks ago I was introduced at the Wood Chemical Association Meeting in Chicago by the President of that Association, and he said there that a year ago, before he became a member of our Committee, he had been using standing timber, competing with the lumber man and the pulp man and the rest of them. He got the idea, at one of our meetings to use what we call non-utilized material, often referred to as waste, and last year he bought 460 carloads of wood waste from other mills. Now you are all interested in this because it means revenue to the railroads in the way of freight.

Now in order to build up these by-products industries and relieve the drain on standing timber, we started, on the first of June, last year, to make a survey of non-utilized material in the State of Virginia. We sent out questionnaires to over 1200 saw mills and wood-working establishments, asking them to list the number of carloads of material of which they were willing to dispose. Now we have received about 60 or 65 per cent returns on these questionnaires, and by the end of the year we hope to have 75 per cent returns. When we have these questionnaires sorted and arranged we will proceed to map the State of Virginia, and definitely place the mills or the sources of this material, so that a man who is interested in chestnut slabs can find exactly where to go; a man who is interested in spruce edgings can find where they are, and so on. And we know already that that work has been of practical importance. I have had two very important manufacturers from other states come to our office in Washington to request our help locating supplies of this material. We are going to extend the survey to other states. We are starting about February 15 in another part of the country, and we hope in time to cover the entire country that way.

Now it isn't only in by-products that we are interested. We are also keenly interested in having the public make better use of these

forest products, and for that reason we are now preparing what we call "A Manual on Wood Construction".

Now all you men know that you have these manuals on steel and Portland cement and many other lines, but I would like to ask you if you ever found a manual with that information on wood construction. We have consulted publications as far back as 1720 in the Congressional Library; we have had all the agents of the Department of Commerce, more than a thousand of these, U. S. Government agents, located in this country and abroad, on the lookout for this, and we have not been successful in finding anything complete along those lines under one cover. The information is scattered in several hundred books.

Now we are making this a one year's program. We are calling on the railroads, the contractors, the builders, the engineers and architects all over the country, and we have a mass of information collected which we are now whipping into shape.

Secretary Hoover appointed seven of the leading builders, architects and engineers in the country to act as a control committee for this manual, because we all realize that the manual will be of far reaching importance. I don't know how conditions are in this state, but I can state, from what I have seen elsewhere in the country, that millions and millions of dollars are lost every year because the builders have not known what they should know in regard to wood construction.

We have been blaming the wood in the past. As a matter of fact the best of materials may be ruined if they are not put together in the proper way. That is what we have found; you can do it in steel; you can do it in anything. By not using properly seasoned lumber you can ruin a whole building—if you don't believe it come to Washington and see the house I live in.

About a month ago we went from yard to yard in Washington in order to pick up 40 feet of lumber, any kind, but properly seasoned. We couldn't find it. We had to build our models, representing seasoned construction, of green lumber. I hate to confess it but that is a fact. So you can see how serious this matter is.

I may say that this manual on wood construction will give a very considerable space to railroads and railroad requirements.

Then I would like to dwell briefly on the question of wood preservation, because the railroads have been the pioneers in that line. We are trying now to make preserved wood available to the average man in the street. In other words, if I want to have 50 feet of preserved wood to be used for a sill in my house or for the back yard step, or for fence posts, today I can't get it; they don't sell it in small quantities. You in the railroad business can get it because most of you have your own plants or order in very large lots. Now

we started in St. Louis, we picked out one of our members, a retailer in St. Louis, and he is now handling treated lumber and meeting with considerable success.

Now the Committee does not attempt to pass judgment on the relative effectiveness of various wood preservatives—we leave that to the laboratories and other institutions. We are simply trying to make the public interested in the use of preserved wood, and to make the dealer interested in handling it as regular yard stock.

Now I think I have taken up a lot of your time. I just want to mention this before I finish. You may often wonder if it isn't a good plan not to use wood at all just in order to save timber. It seems so. We have oil, we have minerals and what-not, and the less oil we use the longer the supply will last, and the same with the minerals. We believe that we will come to the end of our resources in regard to iron. Of course, the less we use the farther we will be able to defer the time when these resources come to an end. Now if you believe for a minute that by not using wood, and by using other materials, substitutes, that that is going to help out a particle, you are sadly mistaken, because it is use which creates value. We must put timber to the best possible use, in other words, when a tree is felled we must get as much out of it as we possibly can. If this is not done we are hindering industry. By using wood in the proper manner we are enhancing the value of standing timber, and thereby we have the real basis for reforestation. You can no more expect the lumber man or the timber owner to raise trees for the mere purpose of having something pretty to look at, than you can expect the cattleman to raise buffaloes for the sake of stocking our National Parks. And I am very much afraid that if the wood using public does not realize responsibility and its interest in this problem of wood utilization, we will have forests relegated to the National Parks for recreation purposes.

Mr. Chairman, I want to thank you for this opportunity of meeting the railroad men. I think it is the most important meeting we have had for a very long time. If we could induce the railroads of the country to give the other users of wood a good example, by changing from some of the wasteful practices now existing, then I think we have accomplished much. I thank you. (Applause)

CHAIRMAN DORWORTH: I know you will all agree that it has been a treat to listen to this very interesting and instructive talk. I know, from a few moments' chat I had with him before his address, that he is perfectly willing to discuss any point anybody might want to raise during the course of this meeting or at any time later.

Announcements by Chairman Dorworth

With the three very interesting talks we have had this afternoon I think you will all agree that we have gotten off to a pretty good start. I think it is a good time now to declare a recess until this evening at eight o'clock.

The meeting adjourned at four-ten o'clock.

TUESDAY EVENING SESSION

December 6, 1927

The meeting convened at eight-ten o'clock, Chairman Dorworth presiding.

CHAIRMAN DORWORTH: During the dinner hour we had a chance to check up a bit and it is very interesting to note that this is the best attendance at such a Conference that has been held to date.

I am not going to waste time tonight with any preludes, but am going to introduce the first speaker of the evening, Mr. O. C. Cromwell, Assistant to Chief of Motive Power and Equipment, Baltimore & Ohio Railroad Company, Baltimore, Md., and his subject is "Railroad Interests in the Development of the Forest as a Nearby Source of Tie and Car Timber." Mr. Cromwell. (Applause)

MR. O. C. CROMWELL: Mr. Chairman and Gentlemen: I have been delegated by our Operating Vice-President, Mr. C. W. Galloway, to prepare and read a paper on "Railroad Interests in the Development of the Forest as a nearby Source of Tie and Car Timber".

Mr. Galloway is very much interested in this question, not only of the development of the tie and the car timber but of everything that relates thereto, and he tries to keep us men who are interested in this line well acquainted with our duties. Having been a railroader all his life, having grown on the property since he was a messenger boy, he is well fitted to observe whether the rest of us fellows attend to our business or not, and we believe that on our railroad, as well as other railroad systems, that is not an uncommon condition.

It is a pleasure to have the opportunity to present a subject of so great an importance to our Railroads, as well as our neighbors the "Farmers and Land Owners". With the fear of repeating something that has already been presented or prepared, I crave your indulgence.

I don't attend these gatherings very frequently and I am not probably quite as well posted on what has gone before as some others, and hence I probably may say something that has already been presented.

The day is here when we must live in community of interest, each receiving and giving helpful assistance to the other, making for the economic good of all; it is indeed encouraging to note that we now have evidence of this cooperation.

Timber to the railroads is that one material which we must continue to consume, both in the development of new property as well as in the maintenance of the old, as it is used in the construction of the right of way, constructing and maintaining the road-way, bridges, trestles, buildings, shops, rolling stock and various miscellaneous purposes.

For these uses a large variety of timber is needed, which variety has been greatly enlarged in scope through the urge of economy, resulting in the establishment of preservative timber treating plants by the railroads. The Baltimore and Ohio has two cresoting plants, one at Green Springs, Maryland which when constructed in 1913 had two retorts and increased to three retorts in 1924. The other treating plant of the Baltimore and Ohio Railroad is located at Finney, Ohio.

This treatment results in the doubling and trebling the life according to the kind of wood handled. The decline in the timber and lumber production has been measurably met, by this treatment in increasing the life of the wood, and making available woods heretofore not suitable for use in their natural condition, and further met by the use of steel in place of wood in the construction of many types of cars and in the diminished use for locomotive purposes, yet the growth in the volume of business handled by the railroads for the country has in a measure off-set this and likewise this growth of business must and will continue to make demands for timber and lumber in the future.

The condition as above outlined brings to us the very great necessity of the most earnest consideration of this all important subject.

While at this time we are getting help from the West Coast through timber brought by way of the Panama Canal, however, in no distant time, due to the Western Coast becoming more thickly populated and their timber supply diminishing, the consumption there will tend to increase the cost, and making the call on our own source of supply more urgent, therefore it would seem to be an act of wisdom, to give attention to our own production, in the line of general economy, which is good for the land owner as well as the consumer, the railroads, for as the cost of transportation is kept low the country generally is benefited.

The cost of transportation is largely influenced by those doing business with the railroads and by their helpful assistance such as now experienced in loading cars to full capacity, quickly unloading and returning the cars to service, thus expediting the movement of

the cars and increasing their earning capacity. The success of this effort of community of interest points to another field of economy, namely, the development of the forest as a nearby source of tie and car timber supply, effecting another field which will be beneficial to all concerned.

I would like to stress here this question of community of interest, not only as it refers to the question of timber preservation, but community interest as a whole, particularly towards your railroads.

Your railroads are the great educators of the country, distributing education throughout the whole land, and we men who are connected therewith, and our neighbors, should know more of our several problems. The trouble generally that arises is because we do not understand the other man or his needs or his life or his troubles. We all have our own troubles and he has none. When you come to think how much a railroad needs the assistance of all, probably this question of appeal towards the preservation of the forests means a great deal.

Railroads consume, I suppose, most every article that is manufactured. I don't believe you can name one thing that is produced in the country but what they consume. So they support such industries. They are the consumers of vast lots of supplies, and you need the railroads and you need to give them some consideration.

We have our troubles trying to educate our men. Take this question of preservation not only of timber but of every other supply. That means a constant fight and bringing it to their attention. When I was a kid and lived along the railroad, all the property on the railroad belonged to everybody that lived in the town. If you wanted some lumber you would know where to find it; if you wanted some coal, that was handy. And so the day has come when the railroads have to look after these properties of theirs, and they have to have the assistance of all.

So when you come down to the question of timber preservation, if other countries can ship timber to us and make it pay it seems to me that it wouldn't be a very great effort on our part, just an effort, to produce timber for the use of supporting the means of transportation, in the most economical way.

Let us speak of the kinds of lumber and how used by the railroads; for convenience of analysis, we will place these in three groups, namely—

Maintenance of Way
Motive Power and Equipment
Transportation

Maintenance of Way

In this Department, timber is used for Bridges, Culverts, Trestles, Roadway, Track, Buildings, Fences, Water Tanks, etc. for the following purposes—

Foundation Timbers	Studding
Mud Sills	Sheathing
Cribbing	Siding
Piling	Flooring
Sills	Center Stringers
Posts	Roof Trusses
Caps	Fences
Girths	Cattle Guards
Bracing	Masts
Stringers	Rail Rests
Joists	Signs
Floor Beams	Telegraph Poles
Floor Planks	Cross Arms
Guard Rails	Lamp Posts
Crossing Planks	Fence Posts
Framing Timbers	

I enumerate those to try to give you an impression of the extent of the parts that we have to manufacture and make and use. I imagine I have overlooked quite a number.

For these purposes the kinds of wood used are White Oak, Mixed Oak, Chestnut, Long Leaf Yellow Pine, Oregon Fir, Locust, Eastern White and Red Cedar, Red Oak, Burr Oak, Rock Oak, Chestnut Oak, Tamarack, Western Cedar, Red Wood, Cypress, Elm, Sycamore, Maple, Hickory, Cherry, Norway Pine, White Spruce, Beech, Birch, Hemlock, White Ash, White Walnut, Poplar.

Motive Power and Equipment

In this Department timber is used for the following—

Car and Tender Sills	Siding
Draft Timbers	Lining
Draft Sills	Flooring
End Sills	Side Stakes
Platform Timbers	Moldings
Truck and Body Bolsters	Doors
Spring Planks	Cabinet Work
Ridge Plates	Sash
Side Plates	Patterns
Carline	Cabs
Posts	Bumpers
Braces	Bumper Beams
Belt Rails	Planking
Floor Rails	Side and End Planks
Sub-Sills	Push Poles
Car and Locomotive Running	Grain Doors
Boards	Boxing
Roofing	Tool Handles

making use of White Oak, Mixed Oak, Long Leaf Yellow Pine, Oregon Fir, White Pine, Short Leaf Yellow Pine, Bass, Yellow Poplar,

Cypress, Birch, Maple, Hemlock, Spruce, Mexican Mahogany, White Ash, Cherry and Hickory.

Transportation

In this Department we use lumber for securing certain kinds of loading to cars, such as Stakes, Clamping Pieces, Bearing Pieces, Braces and Blocking. These must be made of straight grained lumber, hard wood preferred, free from knots that materially impair the strength, and as an alternative, green saplings may be used for stakes.

Before the practice of treating lumber for railroad ties was started, twelve kinds of wood were available; since introducing the treatment of the lumber, over twenty additional kinds have been made suitable. This gives you an idea of the wide range and kind and from the statement below, the extent of the lumber consumed by the railroad and prospects of profitable return for the development of forest along its lines.

The quantity of lumber produced along our line, which is an average for the last three years, is as follows—

Oak Bridge Ties	1,300,000 ft.
Oak Switch Ties	10,000,000 ft.
Oak Miscellaneous	1,500,000 ft.
Cross-ties	48,000,000 ft.

All of the above itemized materials are thoroughly seasoned and creosoted at our Treating Plants. In the past three years we have produced along our right-of-way 3,800,000 ft. of oak lumber, used in repairs for locomotives and cars. This material is not creosoted.

The plants that we have are kept quite busy taking care of the creosoting of our tie timbers, and they haven't quite sufficient capacity to take care of that work for the cars or locomotives. Not that we don't believe in creosoting other timbers, but ties lend themselves to such treatment more readily because of their nearly equal size. For this reason they more completely fill up the retorts and we get a more economical charge out of each loading.

Our lumber agent informs me that timber lands existing along our right-of-way, with a spread of 30 miles on each side, if properly forested would have ample yield, sufficient to supply the timber that we consume, of the kind found in this locality, and in addition to supplying our own wants, that of another railroad of equal size, and make it a commercial success, and what is so of one railroad is so of others.

Therefore, gentlemen, it seems that timber for consumption of the railroad can be had first by limiting practice of cutting trees 5 to 6 inches in diameter for mine props to those that might be gathered

by thinning out the trees to permit the stronger ones to develop more rapidly and permitting them to grow into timbers of cross tie size in 20 years, when they will also be available for mine props by splitting or sawing; allowing a heavy percentage to grow into saw timber for 40 or 50 years, secondly, with a slight effort, such as cleaning the land of underbrush, protecting the healthier trees by thinning out the weaker ones, regulating the cutting of the older standing timbers, to admit the necessary sunshine, light and air to the leaves to do their laboratory work, after drawing the sap from the roots, and assimilating with hydrogen and oxygen to be returned to the trunk of the trees for building purposes; thereby giving nature a chance to lay in our laps wealth.

This development of the forest along the line of the railroads brings the market to the door of the farmers and land owners, where the inspection can be made before shipment, doing at his convenience his own hauling, all of which, it seems to me, should be convincing to the timber men of the remunerative value of this subject.

I believe we could stress that side to the owners of the forests along our railroads. Point out to them that they can deliver timber from their own lands right at the door of the market, and have it inspected before it is taken off the property, and the railroad is the means to assist them in this.

On the other side you have the problem of water. The proper handling and supplying of water to locomotive boilers has become more and more a problem since the cutting of the timber lands, permitting the rapid off-throw of the rain so that it is not held in the springs and the streams for consumption by the railroads. They have to go farther and farther away from the source of supply in order to provide water, and the community pays for that more expensive source of water supply. Why not, then, take advantage of our forest lands to hold that water supply? You are not only getting a return for the timber you are going to grow and sell, but you are enabling the railroad to have a supply of water and a better kind of water than they now have.

This question of community of interest is one to which I think our country as a whole wants to give consideration. We can't prevent the wastes of days gone by, but we have to begin to give some attention to avoiding these wastes. To digress a little I might point out what was accomplished by Secretary Hoover during the war to stop waste, by calling in the assistance of every industry. And while we should be looking after our own affairs primarily, for the mutual benefit of all we may say that transportation of the entire country very materially affects your manufacturing industry. I am quite sure the railroads want to give you transportation at the very lowest possible cost, and if we can supply them with the material

which they consume so that they can maintain a reasonable cost, they will give you the true return in transportation costs.

So therefore, gentlemen, I believe that it would be a great reward for any efforts that we made to educate the people as to the importance of this question of forest preservation along the lines of the railroads. (Applause)

CHAIRMAN DORWORTH: I think it is very timely that we now get the viewpoint of a forester on this subject. It is a pleasure for me to call on Mr. R. D. Tonkin, Forester, H. C. Frick Coke Company, Pittsburgh, Pa., who will talk on "Freight Rates on Forest Products and the Effect on Local Forest Development." Mr. Tonkin! (Applause)

MR. R. D. TONKIN: Mr. Chairman and Gentlemen: The thought I would like to put across is the desirability of getting a freight rate that will carry the product of the entire forest, so if you cut selectively, as has been outlined a few minutes ago, or you cut clean, you can still dispose of your product.

Lumbermen realize today that closer utilization and reproduction are the two most important things toward keeping their industry going in the Eastern states. They do not seek special favors in the matters of taxes or freight rates, if these items are equal in industry. The railroads have the same ultimate interest as the lumbermen in the products of the forest—revenue, income, profits or dividends. To this common end the lumbermen and the railroads could profit by more co-operation than they have had in the past. Most of the railroads within this Commonwealth were financed and built on the two great freight tonnages, coal and iron; yet the first freight handled by most of these roads was the products of the forest and where fire has been kept out, that tonnage has continued dependent upon market conditions and freight rates.

The virgin forest of the old days would furnish about forty tons of revenue freight per acre of land tributary to the road. A large percentage being high grade lumber moving East, a small percentage on short haul to local markets. This figure may seem low but due to lack of utilization, more than 50% of the volume of the forest was waste and furnished no tonnage. The recoverable part of this waste or the by-products of a lumber operation does not have the value of the manufactured lumber, but more the nature of raw material to a manufacturing plant—let that plant be tannery, extract plant, pulp mill or chemical plant. Some mine timber would be in this class of material: although not going through a work or plant, it helps produce the one great tonnage, coal.

The second growth forest will continue to furnish tonnage of the low grade or by-product class in large volume if freight rates to plants and mines will permit shipment of practically all the volume that

can be cut from the land at one time. On a very conservative estimate, the average acre of natural reproduction will cut one car load of mine timber per acre on a thirty year rotation, furnishing one ton per acre per year of revenue freight.

During the year 1926 the H. C. Frick Coke Company received over 4500 cars of mine posts with an average weight of $30\frac{1}{2}$ tons per car. The rate averaging $12\frac{1}{2}$ cents per hundred shows that each acre of forest land produced \$2.50 per year in freight revenue from this class of material.

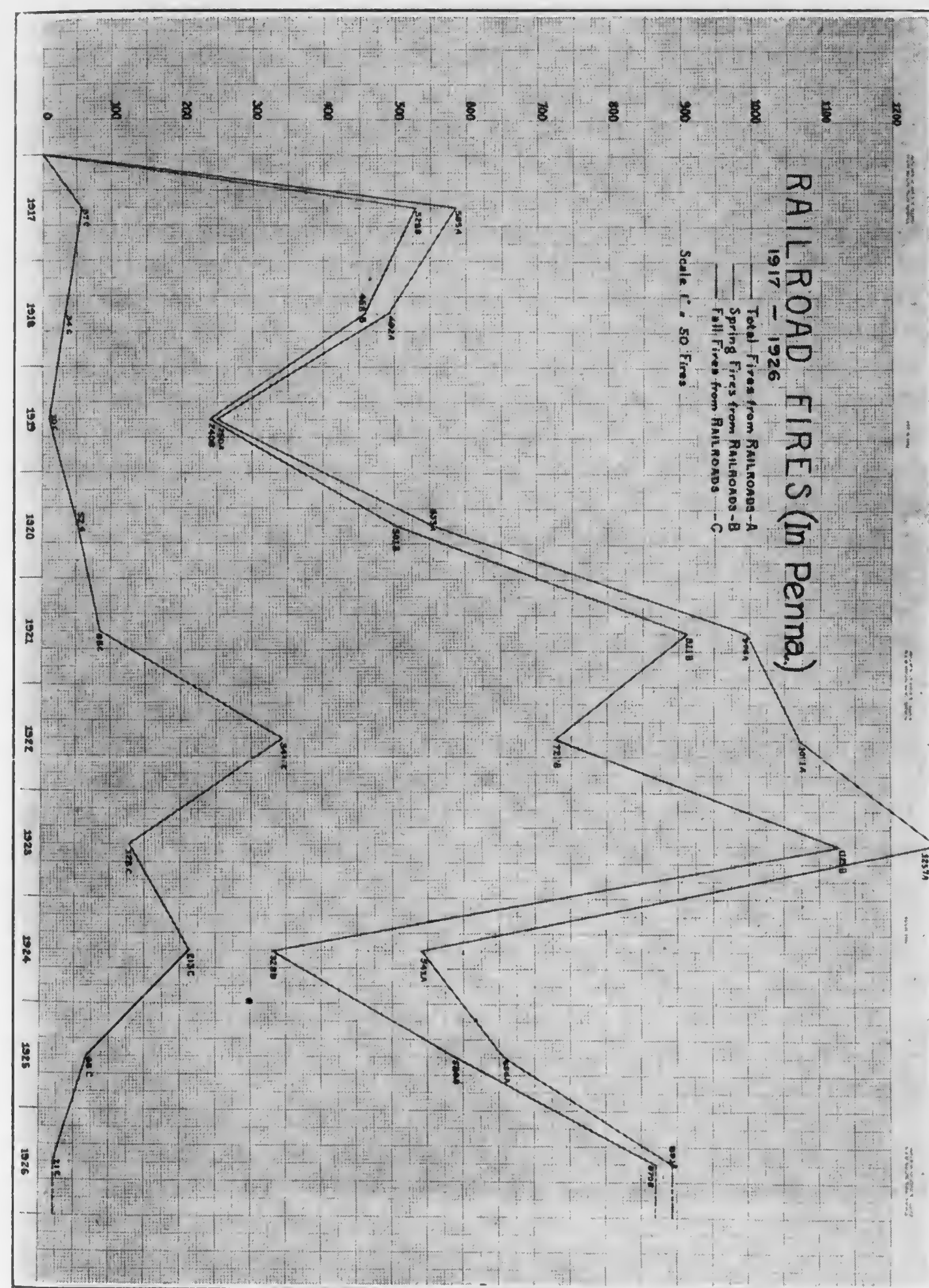
This would be fine were it not for the fact that some localities were penalized very heavily in the matter of rates while others received very favorable rates to bring about this average.

We believe that each ton of forest products freight moving one mile should show a reasonable profit to the carrier and that the great body of idle land in Pennsylvania will not be put to work growing trees until a rate structure covering forest products is established on a basis of so much per ton per mile. Individuals and corporations will practice forestry when it pays. If the markets, as far as rates are concerned, are open to all on a mileage and ton basis, the favorable lands near markets will be developed to intensive forestry on the same general principal that the Lancaster County farmer intensifies his farm operations on high priced land near consuming centers. The lands more distant from market will have less value requiring less carrying charges, less taxes and being further from the industrial centers, a lower production cost at time of cutting or harvest, as forestry is timber farming.

The abundance of lumber in Pennsylvania has helped put her in the position she holds in industry. Putting her lands to work growing forest products will help keep her in the front rank.

We believe that any purchase, sale, trade or freight rates should share the results with all concerned and that a ton per mile freight rate on forest products is good for all. Further, we believe that a business in this state that has furnished \$2.50 per year in freight revenue on a low grade product for each acre of land devoted to forestry is worth fostering and care by the railroads. When the products of the forest can be shifted to the nearest market on a rate in proportion to the value of the product, we will see a much greater interest in forestry and timber farming, and the industries of the state will prosper from the wood chopper in the mountains to the steel mill worker. (Applause).

CHAIRMAN DORWORTH: Back of every successful, worth-while movement, is a successful, worth-while man. In the Department of Forests and Waters we pride ourselves upon having one of the most modest men, I believe, to be found identified with this State's administration. Nevertheless, he is one of the most invaluable, and as his



Department Chief I take the greatest pride in introducing one who is already known to many of you, Mr. George H. Wirt, Chief Forest Fire Warden, Department of Forests and Waters, of the State of Pennsylvania. Mr. Wirt! (Applause).

MR. GEORGE H. WIRT: Mr. Chairman and Friends: Before reading my paper, for fear I may not get another chance before the Conference ends, and probably not even then a chance to speak to each one of you individually, I want to say that personally I am more than pleased with the fact that we have, at this Conference, so many men, representing so many railroads. It has been very gratifying to me to see the response to the requests which we sent out, and it is my hope that the Conference will be worth while to each one of you.

I have chosen for the subject of my paper tonight, "Forest Fires and Their Causes in Pennsylvania," thinking that perhaps some of the inside information we have in connection with forest fire causes may be of interest to you, and that this information at least might be a foundation for some of the later discussions or papers which may be presented.

For more than two decades the Department of Forestry, now the Department of Forests and Waters, has been making a study of facts concerning forest fires. Previous to 1915 some information about fires was gathered together each year, but it was mostly guess work on the part of the informants and it was far from being complete. Aside from general knowledge that there were many forest fires and that they burned without any efforts taken for their control, there were practically no facts upon which one might place any dependence. Even recently very prominent people have made statements to the effect that most of our forest fires are caused by railroads, or by smokers, or by brush burners, or by fishermen in the spring, or hunters in the fall, almost any source in fact, according to the need of their argument. Likewise wild guesses have been made as to the area being burned over annually and the damage being done.

What we have been attempting to do for a number of years has been to get the truth as nearly as possible, to study the facts, and to base our actions upon such facts.

In the first place, it was important that the people of the state should know whether the forest fire problem was of sufficient importance to warrant some kind of policy of prevention and control. That part of the program apparently has been accomplished but many of our people in positions of power are still unconvinced that the expenditure on the part of the state, of \$300,000.00 annually for a few years and then a gradually diminishing amount, will change an annual loss to the citizens of the Commonwealth, amounting to from \$1,000,000.00 to \$10,000,000.00, to an annual asset of as much or more.

It was necessary to know how many forest fires were being started, how many acres were being burned over and approximately what damage was being done, but it was more essential to know when fires were occurring and where. Only with this information could there be built up a protection organization concentrated as to time and place. This we have been trying to accomplish as the facts are developed.

But the prevention of forest fires is the objective of every forest protectionist. For this reason every effort is being made to determine the exact cause of each forest fire. When causes are known and understood there is some chance of eliminating them. Since 1913 our Department has kept records of causes of forest fires. Naturally there have been mistakes made in the reports sent to us. Suppositions and circumstantial evidence have been recorded as facts. On the other hand facts have been covered up and fires have been recorded as of "unknown" origin. But in the earlier years not all fires were reported and it is reasonable to assume that after all, because of compensating factors from all over the state, our tabulations of causes may be taken as representing fairly well, the sources of fires and the relative importance of the various causes.

Much interesting material might be presented as to the peculiar causes of fires, reasons for their being set, or conditions under which they have started and spread, but what we are interested in now are some of the most outstanding facts.

Some few forest fires are caused each year by lightning, the only natural cause of which we have definite record so far in Pennsylvania.

Very frequently we have it told to us that this or that or the other thing starts these fires, and some people go so far as to say that most of our fires in the Spring come from spontaneous combustion—whatever that is. We don't know anything about that kind of fire.

With the exception of 1925 when 62 lightning fires were reported constituting almost 2½% of the total for the year, lightning fires seldom exceed ½ of 1% of the fires in any year. Their number and the loss occasioned therefrom is negligible.

While it is true that large lumber operations are now history, there are hundreds of small operations with engines, dinkeys, and men in the woods constantly. This situation constitutes a considerable hazard, but forest fires chargeable to lumbering have not exceeded 3½% of the total fires reported in any one year and for the last six years have been below 2% of the total number reported. It is common for lumbermen to tell our men that they are more interested in preventing fires than any forest fire warden is, but our inspectors find and point out to the operators many cases of what seems to be

deliberate negligence after which the source of possible trouble usually is very promptly cleared up.

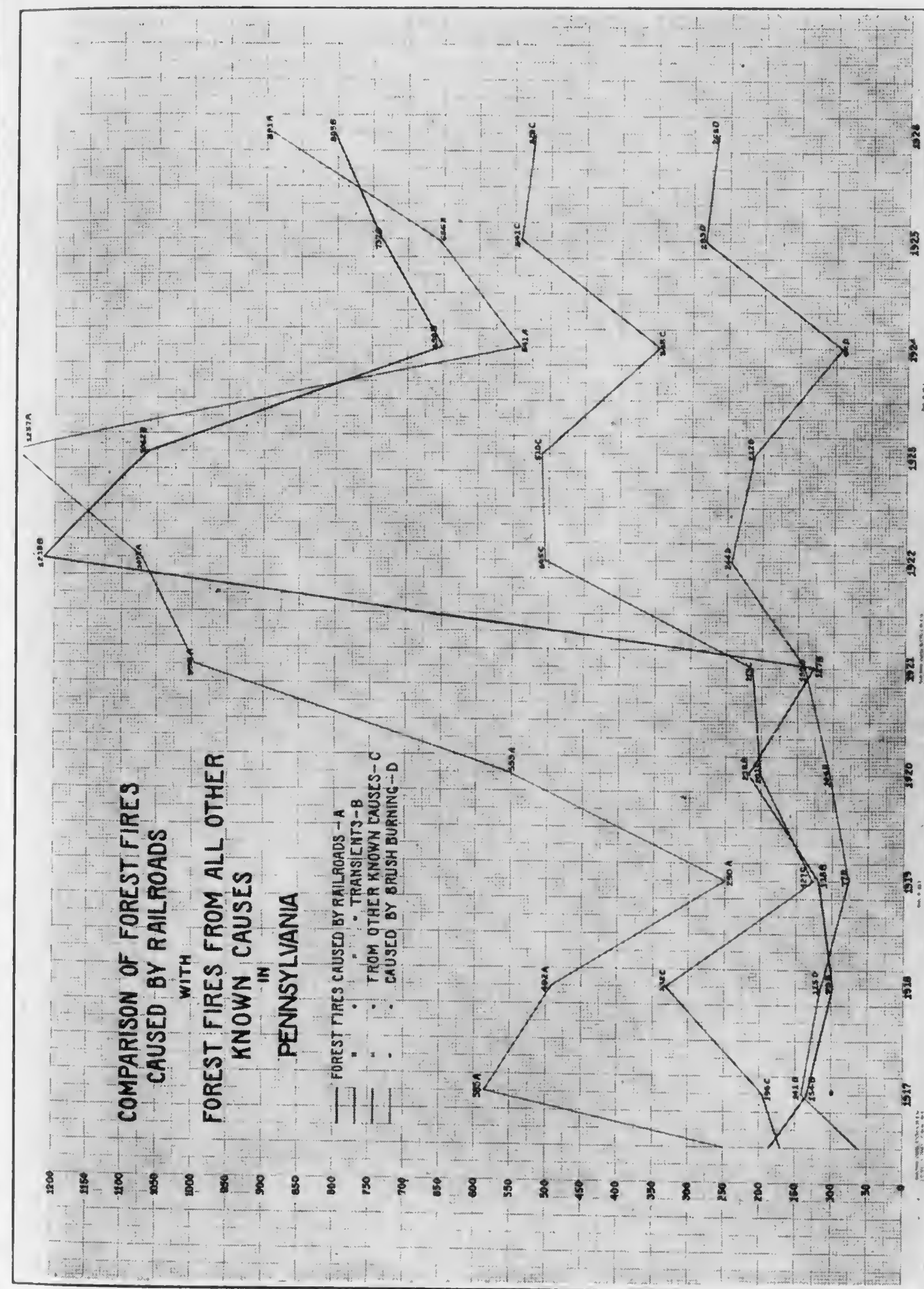
With the thousands of farms and gardens in and near the forest areas of this state and with brush, debris, fence rows, and fields to be burned each spring and fall, naturally there are thousands of chances for forest fire. Likewise with miles of rights-of-way of telephone, telegraph, power transmission, oil pipe lines, etc., where brush is burned each year, sparks will fly to surrounding woodland. But during the last fifteen years there have been an average of only about 150 forest fires per year that have been directly and definitely traced to brush burning. The greatest number in any of those years was 283 or 11% of the total number of all forest fires for that year. The average is about 7% of the yearly total.

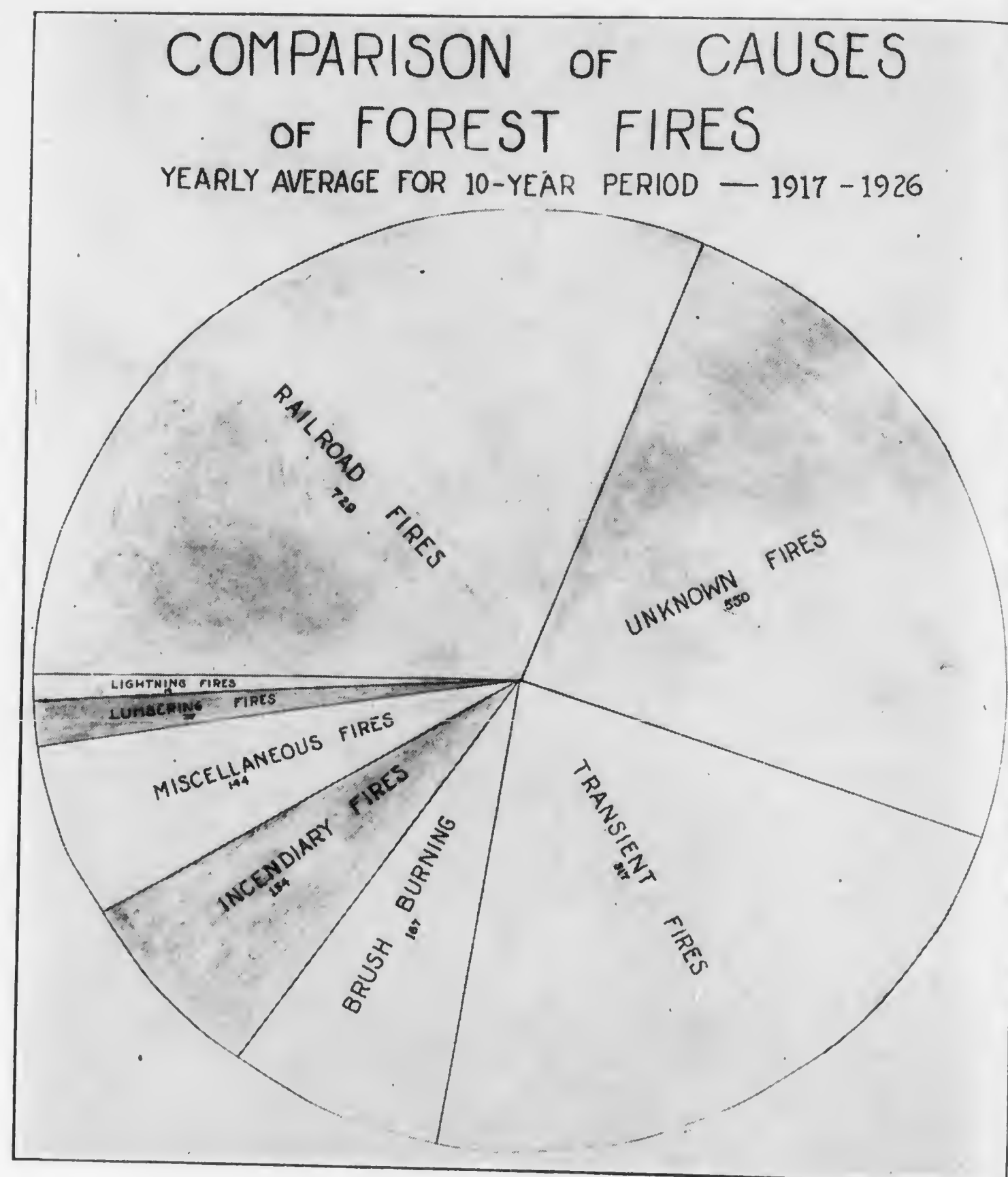
It is difficult to fortell where brush burning fires may arise but corporation men are being trained in proper brush disposal methods. One company recently issued orders for the prompt dismissal of any man who permits a forest fire to start from his brush burning operations. That, only after prosecution had been brought for having let three or four fires get away. Forest fire wardens are cautioning farmers and others as conditions are found indicating that brush is to be burned.

Frequently it is recommended that a brush burning permit law be passed and enforced in order to eliminate this source for forest fires. One only needs to raise the question whether thousands should be inconvenienced in order to attempt to change the carelessness of several hundred. Or why regulate the brush burner in more or less necessary activities when four and five times as many fires come from casual visitors to woodlands who apparently cannot now be regulated?

A still more uncertain hazard is the incendiary—the one who is intent upon having a forest fire and who chooses the right time and place to accomplish his purpose. Not all of our forest fires are caused by malicious individuals as some people think. In most years incendiary forest fires are fewer than brush burning fires. The real cause in these cases is a malicious frame of mind and the prevention of such fires is next to impossible. We have been successful in having the legislature distinguish between the person who starts an incendiary fire and the one who causes a forest fire through carelessness, but, of course, the incendiary must be caught before he can be punished and few are caught. We know certain conditions which have resulted in incendiary fires and where those conditions develop our organization endeavors to remedy them or to be on the lookout for the fires.

There is within the boundary of Pennsylvania an area of over 13,000,000 acres of forest land which at certain periods of the year





is covered with very inflammable material. Probably several million acres of other land covered with inflammable material adjoin forest areas. Through this tremendous area are thousands of miles of highways, railways and other ways along which and from which travel the millions of our own population and those of other states. A quarter million fishermen are along forest streams in spring. Over a million people are known to have visited the State Forest Parks mostly in spring and summer. A half million hunters are in the woods in fall. Millions of flower pickers, berry pickers, picnickers, students, vacationists, and worst of all smokers are traversing the woods, particularly on the very days when the forest floor will burn most readily. Discarded matches and smoking material, and carelessness with camp fires cause an increasing number of forest fires. The amazing thing is that there are not more of them. Casual travelers through the forest are known to us as "transients" and for the last five years, forest fires from this source have averaged a little more than 30% of the total fires each year, in number from 700 to 1200. In the previous ten years the average was slightly over 10% of the total number per year. It is evident that there has been a tremendous increase in the number of people frequenting the woods of the state in the last few years and necessarily the number of examples of individual carelessness with fire has increased.

General and continuous education through the schools and elsewhere not only in Pennsylvania but all over the United State seems to be the principle preventive measure for this cause although conditions may demand shortly the closing of certain areas of forest during fire seasons, and forbidding of smoking while moving through forest areas, restrictions as to the building of camp fires, etc. Forest courtesy must become the common practice among those who use the property of others or their privileges may of necessity be curtailed.

There are in Pennsylvania between 11,000 and 12,000 miles of standard gauge railroad right-of-way. A recent incomplete study shows that there are over 4,000 miles of track bordering forest areas. Many more miles are bordered by abandoned or unprotected fields which adjoin forest areas. With from 2 to 200 engines a day traveling along these tracks, the chances for fires are exceedingly plentiful. It is not unusual to hear it said that all our forest fires are caused by railroads and that if there were a law to compel railroad companies to have spark arresters on all engines, most of the forest fires would be prevented.

Our records show that the greatest number of fires in any year attributed to railroads was 1,257, constituting 35% of the total number for the year 1923. However, in several of our State Forest Districts railroad fires have reached 50% to 60% of the fires handled

by our protection forces. For the last five year period, railroad fires have averaged close to 30% of the total number reported. In 1921, our records place the responsibility for 41% of the fires upon railroads.

It is true that railroad rights-of-way are fixed as to location and because of this any fire that occurs within 200 feet of the track is likely blamed upon railroad operation. Occasionally we find such cases where the railroad is blamed unjustly, but for every such case there are several other fires which no doubt have come from railroad operations when other conditions are present which result in their being thrown into the classification of fires from "unknown" origin.

Many people and even a few railroad men are of the opinion that all railroad fires come from sparks thrown from smoke stacks. This is far from the facts in the matter. Sparks from other sources are just as effective and many times more so. Likewise it is believed that if sparks large enough to set a forest fire are thrown out of the stack, there is no screen in the stack or the fireman has punched a hole in it. We frequently have that stated to us by people who live along the railroads. We don't believe it. We have found that in the majority of cases spark throwing engines have good screens but they are imperfectly installed. In the case of over 50 engines recently examined by our men on one division and after the regular inspection had been made, more than half of the spark screens were defective because of incomplete fastenings. In every case the trouble was corrected before the engines went on the road and no doubt fires were prevented.

Ash pans are a prolific source of forest fires and it is just as important to see that they are spark proof as it is to have the spark screen correct. Wire mesh may be needed at places, the slides and hopper doors may be warped and the engine may be run with front or rear of ash pan open, usually contrary to railroad orders.

Enginemen are human and occasionally violate their orders. Recently one of our fire wardens was watching for fire at a point where there is not much space between the railroad and a cliff along which the road runs, but at the foot of which leaves gather and if fire starts it finds its way to the top of the rocks quickly. An engineman threw off a red hot brick from the engine arch and is reported as having been given a two weeks' lay off. Fortunately the brick did not hit the warden but it did not miss him by much margin. Had he not been there at the time a forest fire would have resulted for he had a hard time to prevent the leaves, which burst into flames immediately, from carrying the fire up hill. Hot clinkers are occasionally thrown from engines.

Trainmen and passengers have not infrequently discarded matches and smoking material, which lighting on inflammable material along

the track has started the fire which has spread to the neighboring forest. Fusees occasionally are carelessly set off or the track is not clean and fire has been carried by grass, or leaves to the ditch and then to the forest.

Trackmen, too, have caused railroad fires, or have made conditions possible for their start and spread. Cleaning right-of-way is common practice. Much mowing is done. The vegetable material is permitted to remain on the right-of-way until it becomes dry. A spark from any source falls upon it and the forest fire results. Or the right-of-way is burned over. The fire is set at the track with the idea of stopping it at the edge of the right-of-way, but the wind or something else prevents its being stopped and the men fight fire all night. Not infrequently old ties are piled contrary to orders and burned at the edge of woodland or at a dry windy time when sparks will carry considerable distance.

It will be seen, therefore, that while it is eminently desirable to prevent railroad fires, the problem is not as simple as some think.

Our Department has been trying for years to have safety strips developed and some very gratifying results have been accomplished. We look forward to more extensive development of safety strips next year under the arrangements worked out between our Foresters and railroad men. We are also very much interested in the planting of evergreen screens along railroads and have several such plantations under observation.

Patrol after trains is another measure which must be restored to in a number of places and under special conditions. Engine inspection is absolutely essential and our men are more than willing to assist in this work purely on a cooperative basis.

Clean rights-of-way are now demanded but not obtained. They are essential also as a fire prevention measure. Other things must be done as occasion demands, but all should be done with some degree of consistency. We are just as anxious to avoid the unnecessary expenditure of money on the part of the railroads as we are to have fires prevented. I wish you men would get that. Not so very many years ago a certain division engineer got the gist of our safety strip idea, and took his men and developed a back line; that is the line at the edge of the safety strip from which fires should be set to burn toward the track, and he spent \$200 a mile making a trail back there. I understand that just recently there was an occurrence where a certain railroad was made to pay as high as \$1700 a mile for safety strip work. Now whether those figures are correct or not I don't know, but if they are they are pretty nearly the price of a good road. In the first instance, with which I came in contact, the \$200 a mile business, I simply told the engineer that he was wasting the railroad's money. We would rather have had ten miles developed for that

\$200 than only one mile of trail, because we know it would have prevented more fires. Therefore, we do not hesitate to report such unnecessary activities any more than we do to report a fire. Likewise, we are sure that passing the buck from Motive Power Department to Maintenance of Way Department or vice versa will not accomplish results.

There are always a few fires, the cause of which are known but are unusual, as the breaking of a power line, the flying pieces of an over heated brake shoe from an electric car, sparks from some portable engine, etc. These fires average about $3\frac{1}{2}\%$ of the total although in the last few years this has increased to between 6% and 7%.

Then there is the class of "unknown" fires. Not enough is known as to how they start to give them any place in the other classifications. Such fires have run from 44% of the total in the earlier years of record to 13 % and 14% in the last few years. As the protection organization improves and as fires are reached more promptly this class of fires should be decreased.

We have a very interesting lot of figures and charts with respect to causes of forest fires and if any one is interested in the details we shall be glad to go over tables with him.

The Secretary has already called your attention to the charts about the room, and I trust that each one of you will study them, at least to some degree, before you leave the Conference.

After all the cause of forest fires is carelessness. There is no reason for fire to be in the forest except for a particular purpose useful to man and to be so it must be under control. If it escapes from control, some one has failed to take sufficient precautions to keep it where it belongs. We do not believe in the "accidental" fire nor in the "act of God" alibi. Further we believe that the fundamental prevention measure is accountability for one's acts. Carelessness is a state of mind. Accountability affects it quicker than any other form of education. However, we must never let up on teaching the value of forests, the curse of uncontrolled fire, and the tremendous loss in the aggregate when fire rages in the forest. And it must always be remembered that no matter how a fire starts the damage it does will be just the same as though it started from any other cause. (Applause)

CHAIRMAN DORWORTH: At this time I am going to ask Mr. F. C. Krell, Forester, of the Pennsylvania Railroad, to read his paper, "A Railroad Forest Fire Prevention Program." Mr. Krell. (Applause)

MR. F. C. KRELL: Mr. Chairman, if you please, Mr. Kilby has a question he would like to ask Mr. Wirt before I proceed.

MR. W. H. KILBY: I would like to ask Mr. Wirt, in keeping the statistics for 1923 showing 35 per cent of the fires caused by

railroads, whether he has the percentage of area burned over by those fires as compared with the area burned by fires from other causes.

MR. WIRT: Answering just in general, until I can find the exact figures, it is very interesting in the study of our figures to observe that pretty generally, from 1913 to date, being the period over which we have kept our figures, if the percentage of fires caused by a certain agency is 35 per cent, the area burned over sticks pretty closely to the same percentage. Now we will see how that checks up. It doesn't in every case but it does in the majority of cases.

In 1923 the total number of fires was 1257; that is 35.52 per cent of the total number. The 1257 represents the total number of fires attributed to railroads. The area burned was 124,799.28 acres, representing 33.22 per cent of the total area burned. The damage was \$233,945.16, which is 29.437 per cent of the total damage. The cost of extinction to the Commonwealth for that year was \$44,046.68 which was 27.73 per cent of the total cost.

CHAIRMAN DORWORTH: Are there any other questions anyone would like to ask Mr. Wirt? If not we will hear from Mr. Krell at this time. Mr. Krell. (Applause)

MR. F. C. KRELL: Mr. Chairman and Gentlemen: I appreciate the indulgence granted me in rearranging the program so as to permit me to talk at this time.

Through cooperation between the Pennsylvania State Forestry Department and the railroads, we are today realizing the possibilities and value of a Railroad Forest Fire Prevention Program and it is partly because of this that the State of Pennsylvania stands today among the foremost in this great movement. To the state, it is the preservation of its forests, one of its vital assets; to the railroads, an enterprise representing actual and potential traffic.

The railroads of Pennsylvania are putting forth more effort and expending more money in forest fire prevention than any other agency or industry excepting the State itself; in fact, it has been authoritatively said that the railroads in Pennsylvania were doing more in the interest of fire protection than in any other state in the Union.

A railroad Forest Fire Prevention Program is largely a matter of concerted and organized effort, first; in preventing fires; secondly, in providing the means of prompt detection and extinguishment. The railroads were among the first to recognize the importance of fire prevention and protection.

There is a tendency to condemn railroad operation for altogether too many fires on mere supposition, simply because they occur in railroad territory, whereas reliable investigation is proving that many such fires are due to the negligence and indifference of others. The railroads desire to be entirely fair in meeting claims but they should not, in justice to their owners and the public, pay unjust or

excessive claims. When the liability is debatable, conclusive evidence can frequently be developed by a determination of facts.

The amount of forest protection provided by a railroad is not generally appreciated. The constant patrol of its track walkers, section men and other employes, who have access to the railroad's telegraph and telephone service, constitute an excellent fire detecting organization and fire alarm system. Although fourteen per cent of all forest fires in the United States are attributed to the railroads, these fires are responsible for only five per cent of the area burned. This indicates that a large number of fires are discovered and put out before they have gained much headway, and this is significant testimonial to the efficiency of this patrol system and fire-fighting organization.

The railroads educate their employes in the prevention and extinguishment of forest and grass fires and have issued instructions which are placarded in tool houses and other railroad buildings.

Locomotive design and operation have been developed with due consideration of the fire risk to fields and forests by adopting the best appliances for safe-guarding the lands against the emission of live coal and sparks. These appliances are given frequent and regular inspection, which is recorded in a permanent form requiring the signature of the inspector.

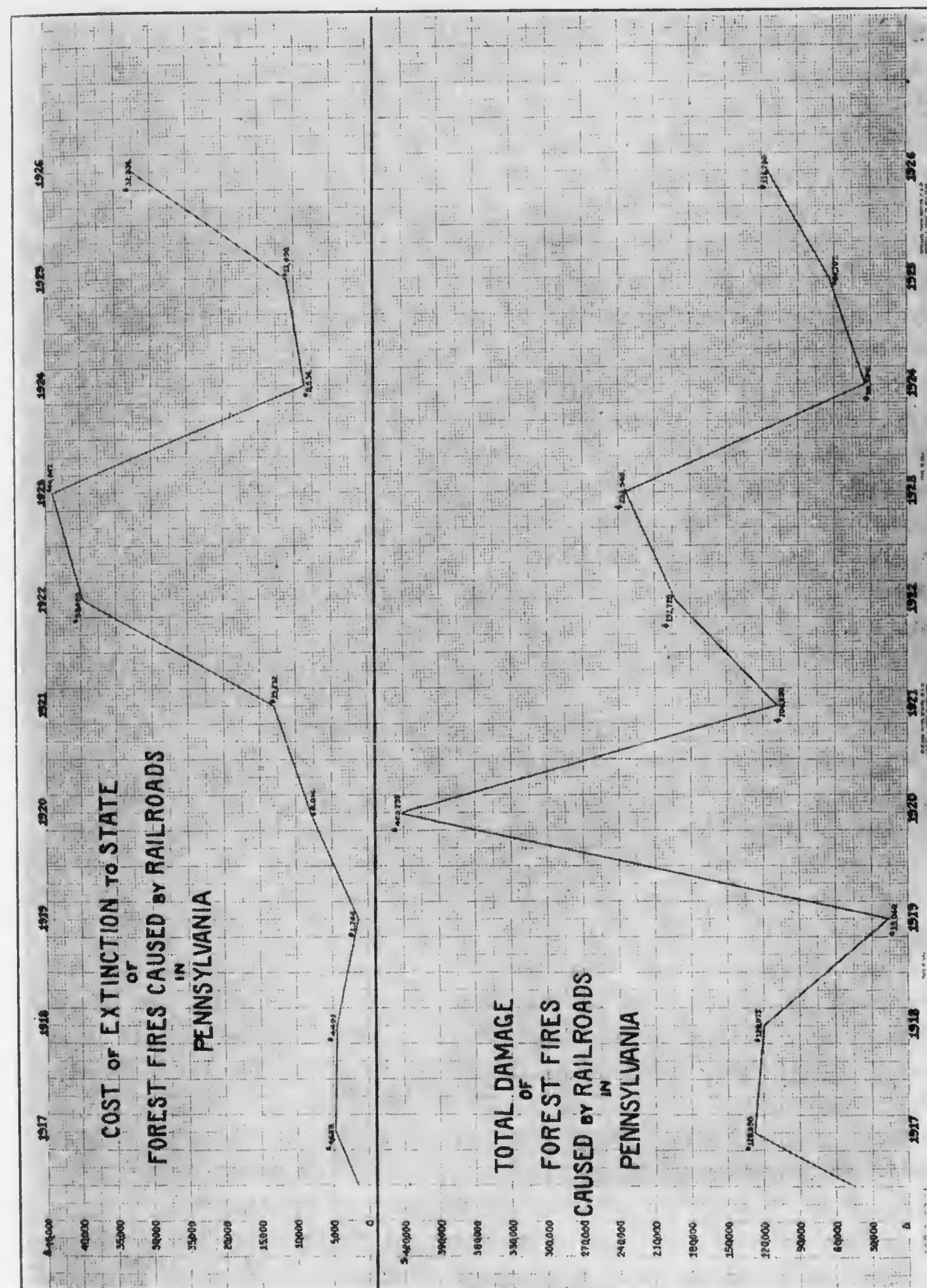
The problems of forest fire prevention presented by the railroad right-of-way have been dealt with continuously at great cost to the railroads. Hazardous conditions, not only on railroad property but on adjacent property as well, are subject to study by railroad officials and the State Forestry Department and the best available means applied for their elimination. It is probably not generally realized that railroad tracks and rights-of-way winding in and around timber tracts, constitute fire breaks which are one of the safe-guards against forest conflagrations—an effectual fire break is to a forest what a fire wall is to a building.

Data and information on all right-of-way fires is recorded on permanent forms for the proper railroad officials.

In line with the practice of cooperation between the State Forestry Department and the railroads, section foremen are appointed Special Forest Fire Wardens.

The railroads are of considerable assistance in placing at the disposal of the State and other agencies their facilities for displaying educational information. Bulletins and placards are posted in stations and other conspicuous locations, to stimulate popular interest in forest fire prevention. The railroads also contribute financially and actively participate in other ways in similar movements.

Timberland owners are placing the burden of fire protection of their property on the State Forestry Department. There is a thought



here of what may be accomplished by securing closer relations and stimulating the interest of forest owners in the program on which the State and the railroads are now so intensely concentrating. If there were a wider popular demand for forest fire insurance, perhaps it would lead to a fuller recognition of the value of fire protection by forest owners because of its influence in reducing insurance costs. A sound fire protection policy, coupled with insurance at reasonable rates, would do much to lift forestry from the realm of speculation and place it on a sound investment basis.

National statistics compiled by the United States Chamber of Commerce for the period from 1916 to 1925 attribute 37% of all forest fires to incendiarism, campers and smokers. Brush burning and unknown are a close second and third with a total of 30% with about 15% each, with the railroads in fifth place at 14%. If 50% of our forest devastation is known to be due to incendiarism, campers and smokers and brush burning, in other words the outgrowth of maliciousness and carelessness, are we not faced with a problem of making this public realize what its indifference is costing and that forest waste is the common loss of all?

We would possibly elaborate further on the activities of the railroads in protecting and conserving Pennsylvania's forests, but after all, no matter what the program may be, the railroads and the State alone cannot achieve their purpose or reap the reward of their diligence if we omit from the program the forest owner and the public. It always has been difficult to educate the individual to a responsibility that he has never recognized and doesn't think that he should. Although the national fire protection associations are conducting a campaign against the deplorable and unnecessary fire waste in this country, fire losses seems to be tenaciously maintaining an intolerable level. However, we can take consolation from the thought that the record would perhaps be far worse if no such effort had been made.

Forest protection has and will always have the sympathy of railroad officials generally, and with more definite knowledge of conditions and of how to meet them economically the prevention of forest fires will be carried on and a fitting program for its realization developed.

Forest preservation is a great enterprise. After all, does not the beauty and majesty of the forests make a sentimental appeal to each one of us? With the railroads participating in this movement whole-heartedly and generously in the future, as they have in the past, and the State Forestry Department continuing its activities, supplemented by an awakened interest on the part of forest owners and the public, it is not visionary to believe that we can lift the State of Pennsylvania from among the foremost in forest preservation to the very top. (Applause)

CHAIRMAN DORWORTH: I would like to inquire if Mr. Paul Warner has come in.

MR. WARNER: Yes.

CHAIRMAN DORWORTH: It would be a pleasure to hear from Mr. Warner, on the subject of "Motive Power Equipment for Fire Prevention". Mr. Warner is in charge of advertising and publicity at the Baldwin Locomotive Works. Mr. Warner! (Applause)

MR. WARNER: Mr. Chairman and Gentlemen: Before discussing this subject, it may be interesting to briefly describe the first trip of a railroad passenger train in the State of New York, which took place at Albany on September 24th, 1831. The late Angus Sinclair, in his book on the Development of the Locomotive Engine, gives the following account:—

"The original intention was to burn anthracite in the firebox of the engine, but a few experimental runs had proved that anthracite would not generate steam fast enough, so it was determined to burn pitch pine. There was no spark arrester, so the force of the exhaust threw out a volume of black smoke freely mixed with sparks, coal, cinders and lumps of half-burned pine. The sparks found their way into the eyes and ears of the passengers, down their necks and into every crevice in their clothing. Those who carried umbrellas raised them to ward off the fiery downpour; but these soon took fire, and the train held a frantic crowd, who slapped out the flames, destroying their own and their neighbors' garments. People by the wayside supposed that the train was carrying a load of maniacs. Consternation reigned supreme, and many people thought of jumping before the engineer perceived the condition of affairs. By that time they were near a water tank, where a stop was made, and the burning garments were drenched with water. Many of the pleasure seekers had painful reasons to remember their first ride on a railroad train".

Travel by rail is not yet 100 per cent perfect, but there has been a vast improvement since 1831

The difficulty of reducing the fire risk attendant upon the operation of the steam locomotive, can best be realized when the capacity and dimensions of the machine are stated. A modern high-power locomotive is capable of developing between 3000 and 4000 horsepower, in a plant which occupies a space approximately 11 feet wide, 15 feet high and 80 feet long. In the largest locomotives, the last named figure sometimes slightly exceeds 100 feet. Within this space is placed the complete power-plant, including the supply of fuel and water necessary for its operation. An intensive development of power is necessary, requiring a rate of fuel consumption far in ex-

cess of what would be possible were natural draft used. In the locomotive this is accomplished by discharging the exhaust steam from the cylinders, up the stack, thus inducing a draft under which coal can be burned at a maximum rate of 4 or 5 tons per hour on a grate area of 75 to 100 square feet. Under such conditions of operation, a considerable percentage of the lighter particles in the fuel escape from the stack before they are fully consumed; and the problem is to prevent their escape, while they are still in a sufficiently incandescent state to start fires along the right of way, and also reduce their bulk so that although they may still be incandescent when ejected, they will be burned out before falling to the ground. This could of course be accomplished by baffling their progress a sufficient length of time to insure complete combustion, but the result would be failure to develop the amount of steam required to operate the locomotive at full power. A compromise must therefore be effected, which will permit as nearly complete combustion as possible without reducing the steaming capacity of the boiler. With the large boilers now in use this is being accomplished to a more satisfactory degree than formerly, when boilers were smaller and grates and fire boxes far more contracted in proportion to the work to be done. In a strictly modern locomotive it is seldom necessary to burn more than 120 pounds of coal per hour on each square foot of grate, whereas in older designs, with very much smaller fireboxes, this figure has at times approached 200 pounds.

The locomotive boiler is arranged with an internal firebox at the rear end, and an open chamber, known as the smoke-box at the front end. The products of combustion pass from the firebox to the smoke-box through tubes of small diameter, a portion of their heat, during this passage, being imparted to the surrounding water. In the long boilers now in use the gases, when they reach the smokebox, are cooled to such an extent that they are of comparatively little value for steam generating purposes. In the smokebox is placed the blast pipe through which the exhaust steam is discharged in order to create a draft; also an arrangement of baffle plates to deflect the course of the gases, and a large area of wire netting through which the gases, cinders and sparks must pass before escaping from the stack. The amount of live sparks escaping depends largely upon the effectiveness of these devices.

It may be asked why the cinders and sparks could not be trapped within the smokebox, and cleaned out at the end of the run. This plan has been tried, but has proved undesirable. The accumulation of a large amount of cinders in the smokebox is a menace, as they are liable to become heated to a high state of incandescence, the result being that the steel smokebox plates are warped and damaged. Accordingly the so-called "self-cleaning smokebox" is now almost

universally used, with a view of breaking up and extinguishing the sparks as far as possible before they escape to the atmosphere.

The exact arrangement of the baffle plates and netting varies on different railroads, and also varies according to the quality of the coal burned. A number of special patented arrangements are used to a greater or less extent, and some of these are giving excellent results. In those sections of the West where lignite, or sub-bituminous coal is burned for fuel, the smokebox is lengthened, and an unusually large area of fine netting is provided. Lignite readily breaks up, and emits light sparks not unlike those from a wood fire. It is exceedingly difficult to entirely prevent the escape of such sparks, but careful design and maintenance of equipment have greatly lessened the fire hazard when burning this kind of fuel.

The internal arrangement of the locomotive boiler has been much improved during the past few years. With larger grates, fireboxes of increased volume fitted with brick arches or baffle walls, and comparatively long boiler tubes, there is far better opportunity for complete combustion than in the short boilers, with small fireboxes having no baffling appliances, that were formerly used.

Another boiler accessory that must receive particular attention if the fire hazard is to be reduced, is the ash-pan under the firebox. The locomotive of 40 or 50 years ago usually had a shallow ash pan fitted with dampers at the ends or sides, through which hot ashes frequently fell on the track. These dampers were frequently made of light material and were liable to warp and get out of shape; while the pan was of insufficient capacity to hold the ashes that accumulated on a long run. The modern locomotive, however, has a hopper-shaped ash pan of large capacity, and the hoppers are closed by sliding or swinging doors of most substantial construction, that cannot warp out of shape. Air for combustion is drawn in around the top of the pan, which is here so shaped that escape of ashes is practically impossible. The entire subject of ash pan design has recently been made a matter of careful study, and the result is an improvement in locomotive efficiency, and a reduction in the fire hazard.

The safest fuel to use in locomotive work, from the stand-point of starting fires, is undoubtedly oil, as with it no sparks are emitted, and with proper handling no oil can drop from the pan under the firebox. It is feared by some that in the event of a wreck, there is greater danger of starting a fire when using oil, but experience indicates that this is not the case. Any break in the oil-pipe connections will at once extinguish the fire in the firebox, which is in itself a safeguard.

The use of oil fuel in locomotives is purely an economic problem. In certain sections of the country it can be burned with economy as

compared to coal, but in the majority of cases it cannot; although there are occasional instances where, in coal burning districts, it has been used at great expense to reduce the fire hazard. From present indications it is probable that no material change in the relative amounts of coal and oil used for locomotive fuel, can be expected for some time to come.

The use of wood as locomotive fuel has been practically discontinued in the United States, although it is still burned, to a limited extent, in certain classes of special service such as on logging roads, where an abundant supply is immediately available. Its use was formerly almost universal in this country, and was responsible for the development of the huge balloon-shaped stacks once so familiar, designed to break up and trap the sparks before they escaped to the atmosphere.

It is a rather curious fact that wood burning locomotives to-day are most frequently used in service where the fire risk is at a maximum, and where every precaution must be taken to remove the possibility of starting fires. Wood burns to a small quantity of fine ash, and by far the greatest danger in operating a wood-burning locomotive is from sparks escaping at the stack. While some wood-burning locomotives are equipped with spark arresting devices in the smoke-box similar to those used in coal burners, it is the more general plan to place the spark arrester in the stack itself. The latter has more or less of a balloon shape, and contains a deflector not unlike an inverted cone, with flanges on its under side. The sparks, striking these flanges, are given a whirling motion inside the stack, and are broken up and extinguished. The heavier particles drop down into the outer stack casing, from which they can be removed through a suitable hand-hole; and only those escape to the atmosphere which can pass through a fine wire netting, placed above the cone.

The majority of the wood-burning locomotives still in use are operating in the South. In the Pacific Northwest, where the lumber industry predominates, oil is generally used as a locomotive fuel, and this has done much toward lessening the fire risk in that region.

An excellent law is in effect in the State of Oregon, requiring that all locomotives built for service in the state must be equipped with a fire-pump of sufficient size and capacity to give 40 pounds pressure in 200 feet of one-inch hose. It would be an excellent plan to apply such equipment to all locomotives operating in wooded regions.

The fireless steam storage locomotive is a form of steam motor which is used, to a very limited extent, in service where fire risks must be absolutely eliminated. While not suited for long hauls, it is fitted for switching service in and about lumber mills and industrial plants where runs are short. In this type, the boiler of the ordinary locomotive is replaced by a cylindrical tank or reservoir,

which is charged with steam and hot water, at comparatively high pressure, from the boilers of a stationary plant. As the steam passes to the cylinders of the locomotive it flows through a reducing valve, and its pressure is lowered to approximately one-third or one-fourth of the initial storage pressure. With the drop in pressure in the reservoir, some of the highly heated water is converted into steam, and the supply is thus maintained until the storage pressure approximates the cylinder working pressure, when the reservoir must be recharged. This type of locomotive is safe to operate and can easily be handled by one man, and in view of this, and the fact that a steam supply is usually available in a large plant, it is rather surprising that it is used to only a very limited extent.

The use of electricity as a motive power would, for obvious reasons, remove by far the greater part of the fire risk in railway operation. The gain in this direction, however, is not of itself sufficient to warrant the very heavy first cost of electrifying steam railroads. Electrification is justified chiefly in the vicinity of large terminals, or on lines carrying a very dense traffic, where the danger resulting from locomotive sparks is not specially great. Certain heavy grade or tunnel electrifications, however, are located in thickly wooded districts; and here there is an undoubted benefit because of the reduction of fire risk.

From the point of view we are considering, electrification would appear to be of special advantage in the case of logging railroads. It is practically prohibitive, however, on account of the cost of installation, and the fact that much of the trackage of a logging road is temporary in character; hence a self-contained locomotive is required, that is independent of a generating station, trolley wire or other equipment of like nature.

A type of railway motor that is attracting much attention at the present time, and has promise of future development, is the oil-electric locomotive. Power is developed by an internal combustion engine of the Diesel type, which uses heavy oil as fuel, and drives an electric generator. The latter furnishes electric current to the propelling motors. The fire risk, in operating a locomotive of this type, is practically negligible; and oil-electric locomotives are now being successfully used, to a limited extent, in certain classes of yard and industrial service. As yet, however, none has been built that approximates a large steam locomotive in capacity; and it is too early to predict whether this will be accomplished in the future.

In spite of its inherent disadvantages, it is more than probable that the steam locomotive will remain the principal source of hauling power on American railroads for many years to come. The degree of success with which fires due to its use are eliminated will be determined very largely by the care with which it is maintained and

operated. If baffle plates in the smokebox are not properly adjusted and netting is allowed to burn out or is carelessly fitted, live sparks will escape from the stack and there will be consequent danger from setting fires. The railroads, however, have probably never done more effective maintenance work than they are doing today, and with a continuance of this policy, and a further improvement in locomotive design, a lessening of the fire risk due to steam locomotive operation may be anticipated. (Applause)

CHAIRMAN DORWORTH: As the concluding number of the evening we have the honor and privilege of having with us Mr. William M. Byrne, who for the past few years has been State Railway Inspector in the Department of Conservation, St. Paul, Minnesota. Mr. Byrne's topic is "The Value of Engine Inspections for Fire Prevention". Mr. Byrne! (Applause)

MR. WILLIAM M. BYRNE: Mr. Chairman and Gentlemen: Mr. Warner might be interested in the fact that I served my apprenticeship with the Baldwin Locomotive Works.

This subject is closely interwoven with the various types of spark arresting devices, their efficiency and the methods of construction, but I will try to stick to my subject and not wander too far off the reservation.

It was said of the minister who used to wander from his subject that if this text had the smallpox his sermon would never catch it. And I hope you don't put me in that category. (Laughter).

The northern portion of the state of Minnesota has an extremely high fire hazard. The area is approximately forty thousand square miles, traversed by ten main lines, five so-called logging roads and many mining spurs. The total mileage is about 4,500.

The companies operating in Minnesota own about thirty three hundred locomotives, of which approximately fifteen hundred are operating in the state at all times.

It would be interesting to me to know how many locomotives are operating in the State of Pennsylvania at all times. I think it must exceed those in Minnesota by a great number.

The Forestry Department was organized in 1911 and the railroad fire prevention work started at that time. I went with the Department in 1912 and have been associated with the railroad work ever since.

It was something new in Minnesota. Wisconsin was better organized so we learned what we could from them. The first step of course was to find out what condition the engines were in—inspection was the order of the day.

We found plenty of defects. A $\frac{3}{8}$ " diameter round rod was used as a maximum gauge. All openings larger than this were ordered closed. There were no regulations at that time as to the method of

doing the work and 16 gauge sheet iron for patches and split keys driven into openings was quite the thing. And I may mention that 16 gauge material, which is approximately one-sixteenth of an inch thick, doesn't go very far on front ends, and particularly on ash pans. They receive pretty hard usage. Cement and putty were thoroughly tried out but found to be poor material for construction or patching.

Inspection reports were made and a copy left at the point of inspection.

As time went on and the inspections were continued, the idea was forced upon us that the quick repairs with light material were not working out, either to the advantage of the companies or improvement in the spark arresters.

We learned also that the shop was passing the buck to the roundhouse. There are several jobs on an ash pan and front end that can be done cheaper and easier in the shop when the engine is torn down and where the men have the large machines to work with, but it was the practice at that time to do only minor repairs on the pan and front end in the shop.

It was one thing for the inspector to realize these conditions and another to have the system changed. A railroad corporation is an immense institution. It has thousands of activities and the calls for men, money and material are ever present, so one additional call would have to be loud and persistent if recognition was to be gained. It was a matter now of "showing" the companies and educating the officials and the men.

Some of the officials were sympathetic and others indifferent. The "imaginary" additional cost was something that would have to be explained by whatever official undertook to advance the work and who except those with courage and foresight wished to borrow trouble?

And right here I would like to give public acknowledgment to the railroad officials of Minnesota who put their shoulders to the wheel at the beginning of this work and helped us carry it on.

The mechanical department upon whom the additional work would fall really had less incentive to go ahead than the claims department or the operating department. The moneys paid out for claims and fire fighting did not appear as a cost to their department and why should they worry.

My personal inspections were kept up and the weak spots continually pointed out, things began to move,—slowly at first but faster in later years. We began to get personally acquainted, which is one of the big factors in carrying on any such work.

Helpers could not do the class of work now called for by the inspector, so regular boiler makers were put on. Considerable trouble was experienced in training the men so they would carry out the work

strictly according to specifications. The front end and ash pan had been considered of minor importance for so many years that it was hard for the old men to break away from this idea, in fact, most of them never did.

A weeding out process has finally resulted in selecting the brightest and ablest men for this work—or men were especially trained for the job. I have inquired of the men if they thought ash pan and front end work difficult and required as much experience as boiler work, and they say it does. A boiler maker foreman who was very successful told me recently that he could see what we were driving at from the start and now that the goal is in sight he is very much pleased. He was one of the easiest men to get along with all these years.

Even with the good will of the companies gained, there was room for many misunderstandings. Practically every operation had to be gone over in detail with the men or the foreman. Mistakes were made light of, inquiries by the officials were answered by stating that the inspector was over-zealous, or there were a few little holes that didn't amount to anything. Another common alibi was "it couldn't be done" or "it was too much work to form the heavy material".

In addition to this there was the honest difference of opinion which was the hardest of all to settle. A suggested improvement by the inspector was generally good for an argument. The company thought their device good enough and while the inspector knew differently because of finding defects, it usually took considerable talking and a visit or two to other roads to gain your point.

With changes of men and officials, the misunderstandings seemed endless. Why not get up a set of instructions to cover all the points, submit them to the companies and have them adopted? This was done and we now have a state law that defines in some detail what constitutes a practical and efficient spark arrester and ash pan and the method of construction.

This procedure has completely justified itself. One of the railroad inspectors and myself were looking at one of the old style front ends the other day, and I turned to him and said, "I don't see how it hangs together. It's no wonder we've been having trouble". Still the front end was in good shape according to the old standard.

From two to four years were allowed to make the change so the work could be done in the shop with the least expense and inconvenience to the companies.

The cost of the new installations is slightly more than the old style but the additional cost is more than made up by lessened upkeep. I would venture to say that the round-house upkeep, in this particular, has been reduced fully fifty percent.

After the engine has been equipped and out of the shop for four years, the front end and ash pan should be rebuilt with new material.

The oxy-acetylene torch is a wonderful help in the work. It has made possible some of the new construction and would be difficult to get along without.

Some of the men complain that the state adheres too rigidly to the regulations. It is true that in State inspections no allowance is made. If the bolt spacing calls for $3\frac{1}{2}$ ", a spacing of $3\frac{5}{8}$ " is not accepted. This caused some extra work for the companies to make the corrections and we were accused of being technical, but it is working out satisfactorily. Now, when the State regulations call for $3\frac{1}{2}$ " spacing, the companies call for 3 or $3\frac{1}{4}$ "—the State regulations 5", company regulations $4\frac{1}{2}$ ", which allows of quick laying out and drilling and still remaining within the limits.

Continuous and rigid inspection is not the whole thing in the progress of this work, but it is an absolutely necessary part and shows the way for improved construction and design. Within the company it is found that the work cannot be kept up without company inspectors. Now here comes the sad part of it.

After all is said and done we have not as yet succeeded in screening the locomotive to a point where they will not set fire and still operate. It is a self-evident fact that the smaller the opening, the smaller the cinder that can go thru. The number of fires set each year varies greatly with weather conditions and the companies are reporting more of their fires than ever before, so the number of fires is not always a measure of the efficiency of the spark arresting devices. We have two cases, however, where it was proven beyond doubt that the use of a finer screen reduced the number of fires about eighty percent.

Of course, all this progress is not the sole work of the inspector. The companies originate most of the new ideas and these are passed on to the other roads.

The inspector should know his subject and use good judgment in what to pass along. If some road has overcome a constantly recurring defect by improved construction, it is difficult for the other roads to refuse to make the change.

The improved conditions react to the benefit of the company. The State is called in at times to testify in court for the companies and the companies use their inspection records in court as testimony and lay stress upon the fact that the engine has been looked over carefully at both ends of the run and its equipment complies with what the State considers an efficient safety device.

I would like to make a few remarks on what we consider aids to inspection. The spark arresting devices should be simple in construc-

tion. The scheme of putting the front end deflector plates forward of the steam pipes has worked out very well. The plates are well forward and easy of inspection, have an angle iron foundation and the whole front end in some designs of engine is constructed without a single patch.

On the Soo Line, down around Moose Lake, we had fire after fire, burning up the whole country, and it got to such a state that we requested the company to remove the standard engines and put on larger power, which they did. But they got to experimenting and got this very fine draft guard, about three-quarters of an inch by one-eighth mesh, and they equipped their standard engines with this and put them into service again, and 99 per cent of their trouble has been eliminated. That is something to think about, mechanical men.

The new Security front end seems to be working out all right. The Security front end is really a barrel made of netting. It does away with all the baffle plates and table plates and spark arresting devices. They had too small a barrel at first and they had some difficulty with the steaming of the engines, due to the small area of the netting, the passage of the gases was so intense through them that they cut out. But now, since they have put in a sufficient area of netting, they are doing very well.

The front end man hole door should receive consideration both as to size and weight as well as design. Simple fastenings and light weight are important. In Minnesota we are using a malleable iron door, fastened by lugs at the bottom and two keys at the top. On first consideration it might seem a minor affair, but I have watched the boys take down the manhole door on the front end so often that really it is very important. It takes a lot of time to take those eight keys, that is, the eight keys in the front end of the standard door, out, and when the engine comes in hot the men don't like to handle that for that length of time, and this door I mentioned with two keys at the top is light and can be taken down very readily, and facilitates inspection very much. There is also a door in use that slides in guides and functions very well.

A practice I would heartily recommend is the hammer test. Once a month, at stay bolt test, clean the front end plates thoroughly, then test them with a ball pen hammer. You will be surprised what you find. This is real inspection. Do not let defects develop.

The company inspector should be relieved of making any repairs if this can possibly be arranged for. And really it is pretty nearly vital unless you have an exceptional man as an inspector. But I would say that in 99 cases out of 100 the inspector should be relieved of making any repairs. Inspectors should also be furnished with flash-lights. It is practically impossible to make a correct inspec-

tion with the kerosene torch; there are too many shadows. Few men will find all the defects if they have to repair them. In any case, his point of view as to just what constitutes a defect will be colored by the amount of labor involved. The companies ordering new power should specify that the spark arrester and ash pan must comply with the company and the State regulations.

Those who make light of or belittle this conservation movement, for such it really is, are on the wrong track. They are opposing an irresistible force. We must have conservation to exist as a nation and far better for all to join with the forces of progress. I have seen this demonstrated several times, thro personal contact.

I have found the railroad officials a well trained, able lot of men, really sincere and trying to do the right thing, though handicapped at times by circumstances.

In conclusion, may I extend on behalf of the Forestry Department of Minnesota an appreciation of the opportunity of being with you at this time and inviting all of you to pay us a visit at any time. (Applause)

CHAIRMAN DORWORTH: That is the concluding number on the program for this evening. If any of you here have any questions to ask Mr. Byrne regarding his experiences or the method developed in Minnesota, I have no doubt but what he would be glad to comply. This brings our evening session to a close.

Chairman Dorworth made several announcements regarding following day's meeting, sight-seeing trips of the City and Capitol, etc. The meeting adjourned at ten o'clock.

WEDNESDAY MORNING SESSION

December 7, 1927

The meeting convened at ten o'clock, Honorable Charles E. Dorworth, Secretary, Department of Forests and Waters, Commonwealth of Pennsylvania, presiding.

CHAIRMAN DORWORTH: I will call the morning session to order at this time.

Announcements by Chairman Dorworth regarding registration, distribution of copies of minutes, etc.

We will now take up the first subject of the morning, which is "Maintenance of Way Activities for Forest Fire Prevention." This will be given by Mr. H. B. Hoyt, Superintendent of the Timber Preserving Plant, of the Buffalo, Rochester and Pittsburgh Railroad Company, located at Bradford, Pa. Mr. Hoyt! (Applause)

MR. H. B. HOYT: Mr. Chairman and Gentlemen: I have been asked to outline our rules and regulations for the Maintenance of Way Activities for Forest Fire Prevention.

The prevention of damage to property on account of forest fires requires, first, that fires should be prevented, if possible, and second, that the promptest action possible should be taken to extinguish fires after they are started.

The prevention of forest fires along railroad right-of-way requires that the right-of-way should be kept clean and free from rubbish, old ties or timber, brush and other inflammable material. It is the practice on this railroad to make a thorough clean-up of our roadbed and right-of-way after the snow is off of the ground in the spring, and again in the fall after the completion of the season's maintenance work. At such times, particular attention is given to disposal of inflammable material, which, except in territory where there is special hazard from forest fires, is burned on the ground under the proper supervision, and preferably while there is still snow on the ground. In special locations where there is a more serious hazard, such material is loaded up and taken to a safer location, and there burned. During the month of July each year, the right-of-way on the entire railroad is mowed and the roadbed and shoulder weeded, the grass and other inflammable material being raked up into piles, away from bridges, trestles, or other property which might be damaged, and burned, except that in locations where there is a special hazard, the material is loaded out and taken to a safer location for burning.

Now, as a word of explanation, on our railroad our engineering department includes the signal department so that the instructions that I am going to outline will include such employees as bridge and building inspectors, track walkers and signal maintainers. Now the track walker will walk over his section twice a day, including Sundays and holidays, and such employees as signal maintainers or bridge and building inspectors go over their territory in a motor car very frequently. The section foreman will naturally get over a part of his territory, at least every day, going to and from his work. In addition, to this, the section foreman is required to make a detailed inspection of his section each week on foot.

All employees of the engineering department, but especially track and bridge and building foremen, are required to observe closely all passing trains, and report at once to the train dispatcher, engines which are throwing sparks from the stack or dropping cinders from the ash pans, which might result in starting fires. Upon receipt of such reports by the dispatcher, the matter is taken up immediately with the transportation department and the engine inspected upon arrival at the first terminal, and necessary repairs made to the screens or other details.

The methods taken to extinguish promptly any fires which start on or near the right of way consist in requiring track forces to be

on the alert to notice any fires and to immediately take what force is necessary from the work they are engaged in, and make every reasonable effort to extinguish the fire. In all such cases, the roadmasters are immediately notified by wire, giving all facts, and stating whether or not it will be necessary for other forces to assist in putting out the fire. In locations where the railroad passes through forest lands, our section foremen are generally deputized as special fire wardens, and perform the duties incumbent upon that position when required. Between the state boundary line, a few miles north of Bradford and the town of Hutchins, Penn., a distance of approximately thirty-four miles, on account of the railroad passing through forest lands where numerous oil wells are located, water barrels with buckets are maintained from early spring until late in the fall, these barrels being located approximately every five hundred feet along the line of the road, and are for the use of fire patrol and other gangs in fighting fires.

Just a word of explanation about this oil country. In quite a lot of this oil territory, what we call the Bradford District, the oil wells are adjacent to the railroad and quite a few are on the railroad right-of-way. Half of this territory is covered by second growth, which is still small, but which, if allowed to grow, will eventually be useful wood. However, fires must be kept from it.

The oil companies, I notice, have a tendency now instead of placing large tanks around the oil fields, probably for the purpose of calibrating their wells, to place smaller tanks at each well, making the tanks more numerous than formerly. Also, around these oil wells, there is more or less oil on the ground from cleaning out the wells, all of which makes it quite necessary that the fires do not get started in this oil country.

We also maintain one or more water barrels with buckets on all bridges with open decks on the entire line. Water barrels are also maintained at stations, toolhouses, labor camps, and in the vicinity of shop buildings. We also maintain during the spring and summer months a special fire patrol gang consisting of foreman and three or four laborers, whose duty it is to patrol the line in the territory where there is the most serious hazard, due not only to the forest, but to the numerous oil wells and oil storage tanks, which might be seriously damaged by forest fires.

Also, at Bradford, which is in the center of this particular district, and at the other terminals, there are engines equipped with fire fighting apparatus. (Applause)

CHAIRMAN DORWORTH: I think at this time it would be interesting to hear from others here as to the methods they have adopted for their roads for fire prevention along the same lines that Mr. Hoyt has outlined with respect to his road.

MR. F. W. BILTZ: I have a little cost data here.

The Reading Company has burned 1,112,484 feet, or 211 miles of fire strip this year, at a cost of \$9,635.19, making the unit cost \$45.66 per mile. This includes only those divisions which traverse thickly wooded country; the divisions covering sparsely wooded farm land where grass is burned from the right-of-way for protection of hay and grain fields have not been included.

The work of burning the safety strips was performed by section gangs with the aid of six extra gangs composed of a sub-foreman and twelve men each; these extra gangs being authorized solely for the purpose of burning safety strips. The tools used were coal oil torches, rattan brooms, Auto Spray Tanks and Rich Fire Rakes. We found that the Auto Sprays and Rich Rakes, recommended by the State Forestry Department, were a great improvement over the old water bucket and garden rake; the work was simplified considerably and it was possible to cover a great deal more ground in a day than could be done with the old tools.

We endeavor to start the burning as early as possible in the spring and work as many of the section men with the extra gangs as can be spared from the track, consistent with safety, so as to cover the entire area to be burned in the shortest time possible.

On one branch, passing through heavily wooded country where the grade is heavy but the trains few in number, the track is patrolled by a section gang with a motor car. This gang follows the train with the idea of extinguishing any sparks that might cause a fire.

Ninety-three per cent of all of the Reading engines have been equipped with the Economy Front End. The remaining 7 per cent, not so equipped, represent small engines working in the vicinity of engine houses, and engines awaiting dismantling, so that all engines used in road service are equipped with this device.

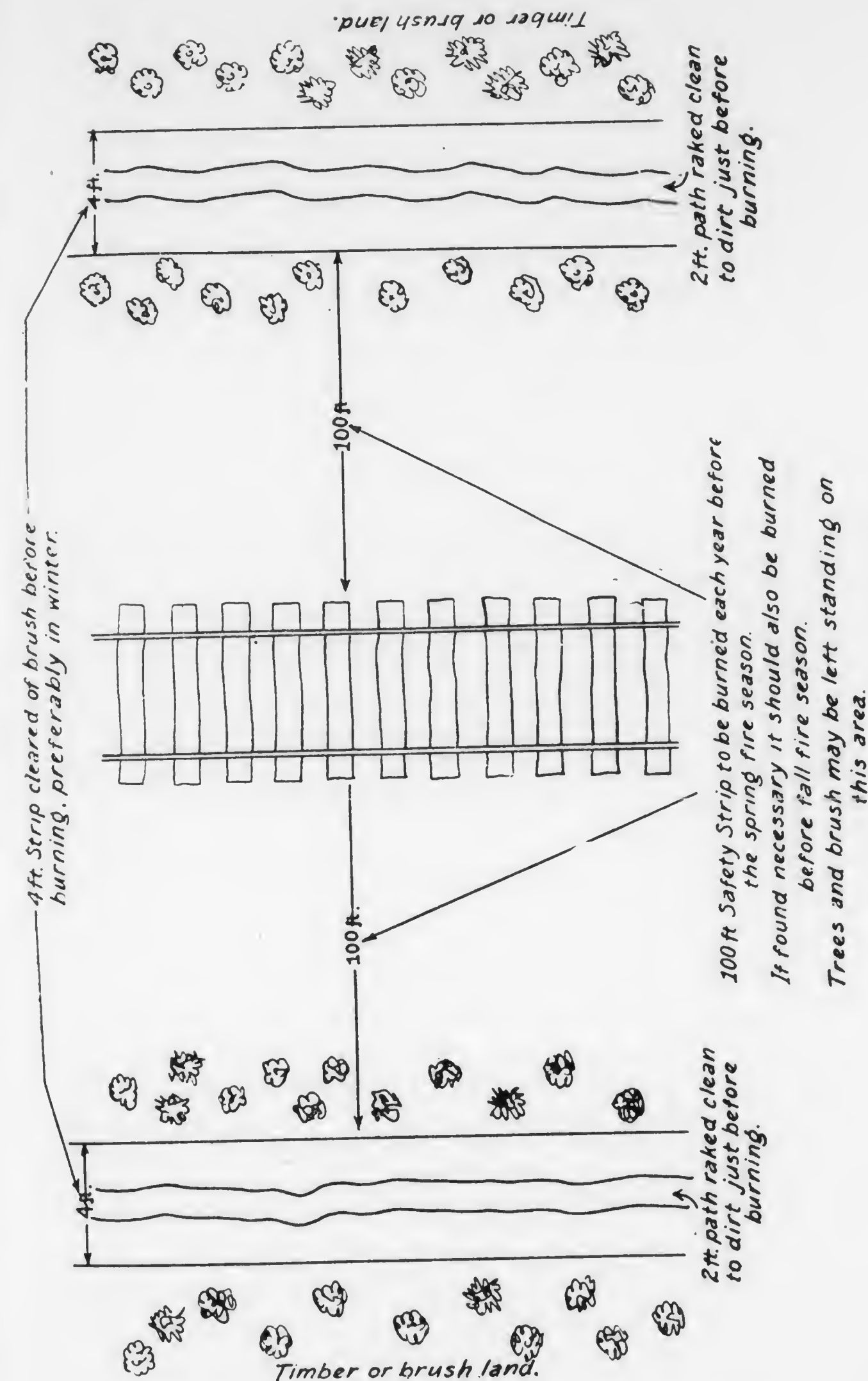
The Economy Front End is fitted with a $3/16 \times 3/4$ inch wire mesh, which makes the possibility of a live coal reaching the ground very slight. The front end is inspected after each run, and if the mesh is found to be burned it is replaced. I believe that the State Inspectors have found the mesh well maintained and with but very few exceptions, in good order.

MR. L. L. BISHOP: Is that unit cost per mile of safety strip or per mile of track?

MR. F. W. BILTZ: Per mile of safety strip on one side. We have quite a bit of territory on our railroad where the railroad parallels a stream, and therefore the hazard is only on one side.

MR. L. L. BISHOP: Does that include the back line and burning as well?

MR. F. W. BILTZ: The back line should be done in the fall; most of this burning has been done in the spring.



DIAGRAMATIC SKETCH OF A SAFETY STRIP

MR. L. L. BISHOP: What width did you use ordinarily?

MR. F. W. BILTZ: One hundred feet when we could get it. Our right-of-way runs about 33 feet from the center line, and when we could meet the farmer or the adjoining property holder, and reconcile him to burn part of his land, we did it, to get the hundred feet.

CHAIRMAN DORWORTH: If there are no further comments I will call upon Mr. Hartenstein, Assistant to the General Manager of the Lehigh Valley Railroad, who will discuss "Safety Strips for Forest Fire Prevention, Methods and Cost." Mr. Hartenstein. (Applause)

MR. F. HARTENSTEIN: Mr. Chairman and Gentlemen of the Railroad Forest Protection Conference: I am glad to have the opportunity of addressing you on this subject.

Preventing fires on the right-of-way belonging to the railroad company that I represent and adjoining property has, in the past, been a very live subject among officials and employees and will continue to be. We are naturally alert in trying to prevent destruction by fire of our own property and realize fully our responsibility in regard to protecting property beyond our right-of-way lines; also the ceaseless vigilance that must be maintained to effect a decrease in the number of fires on and adjacent to our property.

Our Company maintains a very efficient fire prevention organization on each division of our railroad and system shops. This organization consists of nine committees consisting of from twenty to thirty officials and employees in the different classes of service. These committees meet bi-monthly, when a full and free discussion on "Fire Prevention" is entered into and suggestions are solicited and made that if found to be of value are immediately made effective, and in addition to their other duties, they must be on the alert for any fire hazards that may develop, and in their travels on the road instruct employees, in general, regarding fire prevention.

At our large properties, such as shops, roundhouses, freighthouses, docks, etc. we maintain regular fire chiefs and fire brigades, and at all such properties the brigades are drilled once each month, excepting in the City of New York, where they are drilled twice each month. These fire drills are conducted with regular fire fighting equipment, which is frequently inspected and is kept in first-class condition ready for immediate use.

It is our practice to clear our right-of-way of any accumulation of material that appears to be a fire hazard during the fall and spring seasons by burning what is known as "safety strips" from eighty to one hundred feet on either side of the track, depending on conditions, which is supervised carefully by section gangs during the progress of the work to prevent fires from spreading to other property. It is also found necessary to use these same precautions in

FORM USED BY LAND OWNER IN GIVING PERMISSION TO BURN SAFETY STRIP

Form 17

Form 17

.....19.....

.....Division

State of

Name

County of

P. O.

Post Office

Location: Mile Post.....to Mile Post

I hereby grant the.....

on the application of the Pennsylvania Department

.....side of track.

of Forests and Waters the privilege of.....

Permission to burn or plow furrows, a distance

a distance of feet from the edge of

of.....feet from outside rail.

outside track of said Company through my lands

lying on side of the right-of-way

of said Company from Mile Post.....

.....19.....

to Mile Post

(This privilege to continue until I give said Company written notice of its termination.)

Section

.....Foreman

.....Land Owner

some localities during the summer season when there are long periods of dry weather.

In localities where there are fire hazards and it is not practicable to burn safety strips, we patrol the territory immediately after the passage of trains with motor-hand cars supplied with fire extinguishers, water sprayers and the usual assignment of tools used by section men; also track walkers patrol our main and branch lines daily, and in some localities they are patrolled 24 hours per day if there are any conditions requiring it.

We find from our experience that the burning of safety strips is of considerable assistance in preventing fires, and thru use of this preventative, together with other means of fire prevention and fire fighting activities, we have succeeded during the last few years in making a substantial reduction in the number of fires along our line.

The same maintenance-of-way forces that are engaged in general maintenance work burn safety strips and we have never attempted to segregate the cost of burning them from the general cost of maintenance. The cost, however, would largely depend upon the width of the right-of-way, the amount of burnable material to be consumed and the length of time and the number of men required to properly handle the work. In some localities on our railroad in Pennsylvania we have done considerably more this fall in clearing safety strips than in former years, which will be continued as long as the weather permits.

Every official and employe on the railroad that I represent are on the alert to prevent fires. With very few exceptions we carry the insurance on our own property. We have our own fire inspectors who are constantly inspecting the right-of-way, buildings, rolling stock, etc., and these inspectors make prompt reports of any fire hazards observed when making their inspection to the official in charge of the properties and corrective action is at once taken.

It has always been the policy of the Lehigh Valley Railroad Company to cooperate with the Department of Forests and Waters in preserving the forests in the State of Pennsylvania and I can assure you that that policy will be continued. (Applause)

From my own observation, gentlemen, I believe that the Department of Forests and Waters is doing a great job in their efforts to prevent destruction by fire of the forests, and I believe that every citizen in this Commonwealth should render them assistance and give them their fullest cooperation.

I thank you. (Applause)

CHAIRMAN DORWORTH: The Chair feels at this moment that a personal obligation rests upon him to pay proper tribute to one man whose cooperation, influence and support back of the Depart-

ment was instrumental in securing a larger amount of money to conduct the affairs of the Department, and expand and improve its fire fighting service to the extent which has been possible during the past year and which will be possible again during the coming year; on a better scale than had been the case for several years past—due perhaps to an unavoidable lack of funds—but that tribute is due to the Governor of the Commonwealth, Governor Fisher. We have had no more helpful and enthusiastic factor than Governor Fisher, and I feel, in view of Mr. Hartenstein's comment in regard to the efficiency of the Department, that a large measure of the credit goes to one man who made possible the increased amount of funds which gave us our increased efficiency.

I think we would be interested at this point in hearing from Mr. Briggs in regard to the strip burning work of the Pennsylvania Railroad in the western end of the state. Mr. Briggs! (Applause)

MR. Z. M. BRIGGS: Mr. Chairman and Gentlemen: We have been carrying on this safety strip work for the last six years, and it has been a matter, largely, of the education of the supervisors and division engineers to get them to understand just what we were after, and carry out the work with the forces at their disposal.

In general it has been done with the regular maintenance of way allotments and no special appropriations have been made. In certain cases however, additional appropriations have been made for this purpose, and this year we have recommended that more of the work be done in that way. There is a good deal of work to be done in educating the personnel, which is continually changing. The supervisors, particularly, are changed quite frequently, and very often we get men from other parts of the system who have had no previous experience in this work.

Consequently it is necessary for some person to take an interest in it and see that they understand the problem and carry out the work efficiently.

We have received, as I suppose all the other railroads have, track charts on which the Department has indicated the location and information with respect to the various fire hazards, and we have worked to them as much as possible.

In addition to that we have quite a number of the section foremen appointed as special forest fire wardens, and in a few cases we have done some patrolling. But in general I feel that the safety strip is the main thing to rely on, in addition to inspection of motive power.

Now we have had quite good cooperation from the shop people in regard to special inspections of front ends and ash pans. Every spring and fall we issue instructions to make a daily inspection of front ends and ash pans on divisions and districts where there are fire hazards.

In addition to that we find that there is some work necessary with the transportation department; that while the motive power department and the shops may do all that they can to keep the power in good shape, we have found in some cases that the enginemen or firemen have opened the fire boxes or the ash pans to get, as they thought, better draft, and I have talked to a number of engineers, locomotive engineers, and all those that I have talked to personally say that that is not necessary and that it was rather an imaginary advantage. So we have tried to get that under control.

I think that covers our work. (Applause).

CHAIRMAN DORWORTH: Thank you very much.

We would be glad to hear from Mr. C. C. Cook, Maintenance Engineer on the Baltimore & Ohio Railroad, at Baltimore, whose topic is "Cooperation Between Railroads and Adjoining Property Owners for Forest Fire Prevention." Mr. Cook! (Applause)

MR. C. C. COOK: Your Honor, I want to take this opportunity to express my thanks for the chance of listening to this interesting exchange of experiences by the various railroads that are represented here. I will confess that I didn't know what the other railroads were doing, until I came to this Conference, except in a general sort of way, but there have been enough expressions here to indicate just about what is being accomplished.

I was very much interested in the quantity of the work outlined by the representative of the Reading Railroad. We have a situation on our line—I think Mr. Bishop is acquainted with it—where we have quite as many men maintaining a whole supervisor's district as represented in the safety strip work that was described. However, we try to give a proportion, and we hoped that it was a fair proportion, to the assignment of this safety strip work; we tried during the past year and it is our purpose to continue this work during the coming and succeeding years until the situation is cleared up. That represents particularly the conditions with respect to the National Forests in the northwestern part of the state.

I think that most of the railroad men here have recognized that the Department of Forests and Waters must have a very keen insight into the railroad organization. And I think that the success of this meeting is largely due to the fact that you have got representatives here from all of the railroads in the state. And I don't know how you detected that this was the twilight zone between the close of one year and the preparation of programs for the coming year, which would admit so many to continue in attendance here—I think you are to be congratulated upon your insight into that. Probably it is due to your knowledge and experience from contact with the industries of your state.

I have a great pride in your accomplishments because I am a na-

tive of the State of Pennsylvania, born and raised here, and I continued my residence here for a great many years after leaving the state.

It will be well to refer to the interest which railroads have in the subject given for discussion by a general reference to the whole subject of forest conservation and protection,

Altruistic policies are laudable, but unfortunately they have too infrequent application either in our individual affairs or in the business of the firms and corporations with whom we are associated. Self-preservation and the desire for profit constitute practically the whole inspiration for activity in any line of material endeavor.

Railroads quite apparently have in these selfish purposes a sufficient motive for extended and continued efforts to conserve the forest resources. Let us look at a few of the gains which accrue to them from such conservation.

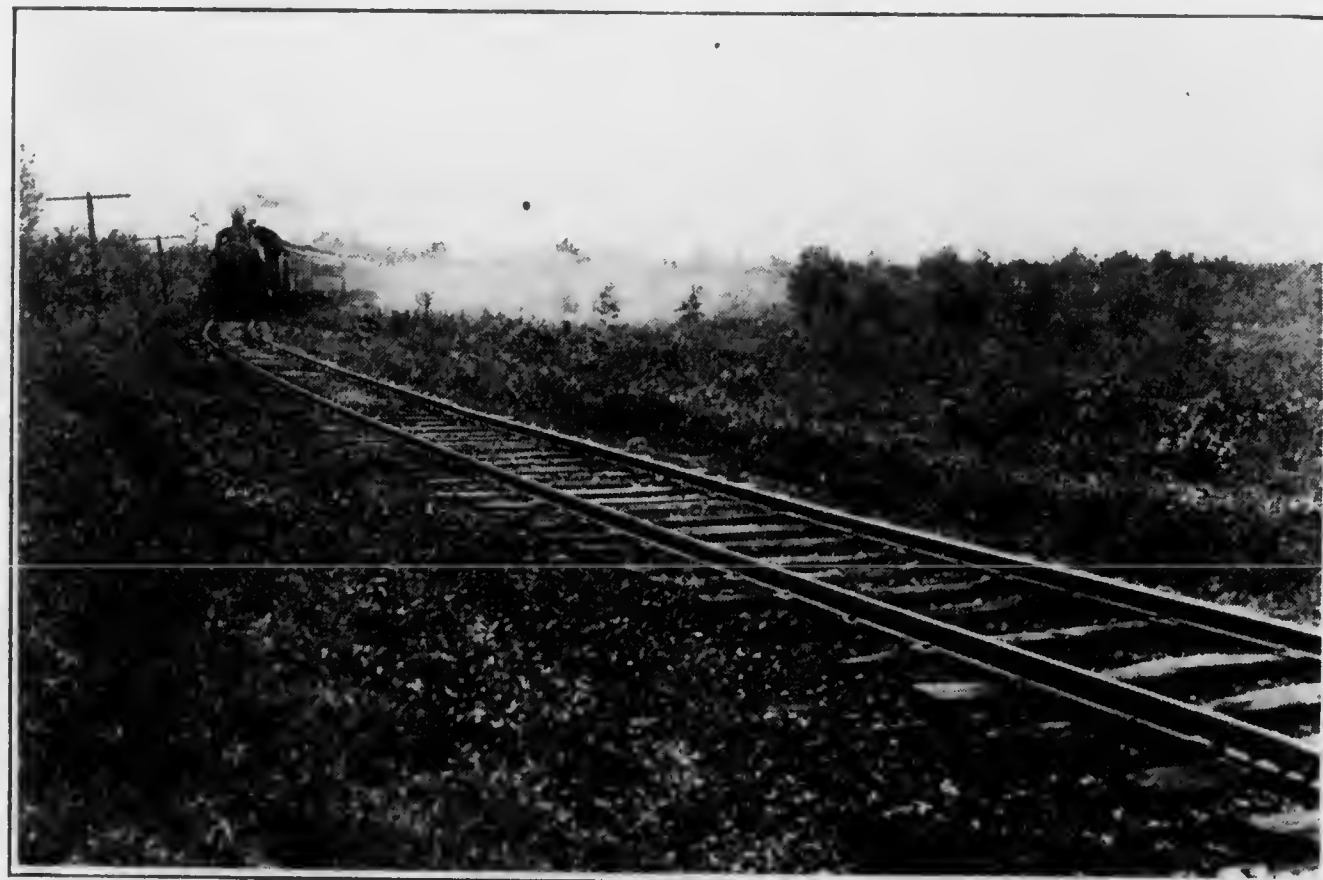
First, they cannot prosper in a territory where natural resources have been exhausted. Lumber had been the basic commodity responsible for the construction and development of large sections of tracks which now form the bulk of leading trunk lines of the country. The exhaustion of timber was in most instances succeeded by developments in other lines of industry that expanded the traffic of these carriers on their through-line routes. In all too many instances, however, it has resulted in laying waste large areas of land unsuited for other industrial purposes, lacking, as they do, the natural resources of more favored communities. Opportunities for quick profits in other regions enticed the pioneers to other fields. The railroads, with large investment in fixed property capable of serving the wasted areas, find themselves with branches now a burden of expense. They are in many cases, simply operated in line with their duty as a common carrier to serve those still residing in a community without adequate production to pay the cost of railroad operations.

Railroads are not in the business of producing lumber; their job is to transport it efficiently and economically. They are, however, vitally interested in giving any reasonable assistance to those who are in that business and in doing all that they can to conserve forest resources.

There is no surprise then in their desire to assist in the regeneration of forests in regions of this character, or to take any action within their power to prevent further exhaustion. And when we are told that within 50 miles of the City of Pittsburgh, in this state, 32 per cent of the land is suitable for forest growth and that almost an equal percentage lies in 12 states north of the Potomac and Ohio Rivers and east of the Great Plains, it is evident that the possibilities in restoration of traffic on these non-profitable lines through reforestation is an allurement for direction of activity that cannot be overlooked.

A corollary of this is the development of a source of supply of timber contiguous to the railroads for their needs in maintenance of their properties. Eastern carriers are being forced to go to the West and Northwest regions of the United States for increasing quantities sufficient to meet their requirements. The declining supply has caused higher prices; the long haul has further added to the cost for forest products, which have continued to mount despite the fact that preservative treatment and other methods of protection have served to reduce the quantities needed.

Another advantage will come from the traffic of allied industries in regions where lumber production continues. Wood working industries, in common with other lines, find it economical to locate at the source of their raw materials. The haulage of new materials to such factories and the delivery of their finished products



UNPRODUCTIVE FOREST LAND BORDERING RAILROAD RIGHT-OF-WAY

are items of traffic constantly fostered by all railroad managements.

A second consideration of selfish interest in this subject is the protection of property from the ravages of fires. Losses in all kinds of railroad property caused by fires have decreased remarkably during recent years. Much of this has been attributed to effective cooperation by owners of adjoining properties solicited by members of the field forces of the Railroad Fire Prevention Association and through the better control exercised by employees in elimination of fire hazards.

There is a reciprocation of action here mutually helpful to the railroads and their neighbors. Losses suffered by owners of adjoining properties have unquestionably decreased, probably in equal or

greater proportion than have those occurring within the right-of-way.

Not the least of the activities in this respect are those which have to do with forest fire prevention. Speaking now for the Baltimore and Ohio Railroad, with which I am associated, and from a knowledge of the operations of other carriers, it can be said that more effective action to prevent spread of fire to forest lands is now being taken than at any time in the past.

There never had been any reluctance on the part of the managements of the roads to give any but the most complete cooperation to National and State representatives who were endeavoring to reduce forest fires to a minimum of loss. There however, is always the problem of educating employees who have diversified duties and responsibilities in the efficient transportation of the nation's commodities, as to the relative importance of measures that need to be adopted to prevent destruction by fire of valuable lands, due often to negligence, indifference and ignorance.

Too much credit cannot be given to the representatives of our governmental forestry departments, who, in season and out of season, have assiduously labored to educate the mass of our people in the elementary precautions for prevention of fires and the effective means for their extinction.

In the railroad field, their efforts have been successful and though a changing personnel and a natural inclination to an easing of efforts which comes from temporary immunity from fires, may always require continued labors on their part, it can be said that the railroad employee on the ground, who in the last analysis can do the most effective work in prevention and extinguishment, is now more alert in attention to the details of this part of his duty than ever before.

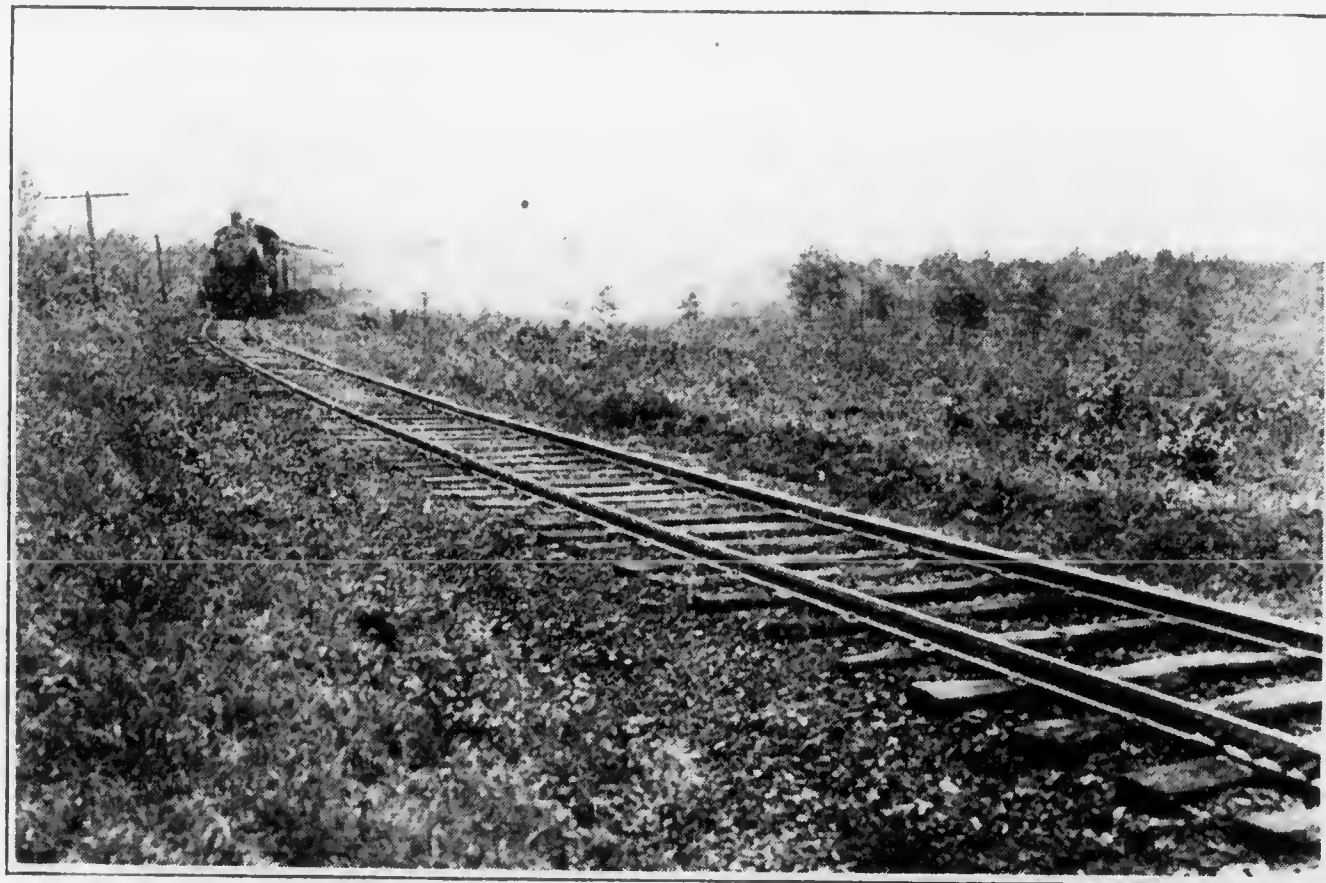
The measures now made effective are those that have been commonly suggested and described as to details of procedure in the letters and pamphlets issued by the Department of Forestry and covered by instructions to officers, foremen and men on the railroad responsible for their accomplishments.

A review of the items will not be amiss:

- (1) Clearing safety strips 100 ft. from nearest rail.
- (2) Locomotive ash pans and spark arrestors in good condition.
- (3) Patrolling behind trains when conditions are extra-ordinarily hazardous.
- (4) Reports by trainmen and other employees of fires noted in adjacent woodlands.
- (5) Response by railroad employees to calls for assistance in extinction of fires on adjoining lands.

A corollary of this is the development of a source of supply of timber contiguous to the railroads for their needs in maintenance of their properties. Eastern carriers are being forced to go to the West and Northwest regions of the United States for increasing quantities sufficient to meet their requirements. The declining supply has caused higher prices; the long haul has further added to the cost for forest products, which have continued to mount despite the fact that preservative treatment and other methods of protection have served to reduce the quantities needed.

Another advantage will come from the traffic of allied industries in regions where lumber production continues. Wood working industries, in common with other lines, find it economical to locate at the source of their raw materials. The haulage of new materials to such factories and the delivery of their finished products



UNPRODUCTIVE FOREST LAND BORDERING RAILROAD RIGHT-OF-WAY

are items of traffic constantly fostered by all railroad managements.

A second consideration of selfish interest in this subject is the protection of property from the ravages of fires. Losses in all kinds of railroad property caused by fires have decreased remarkably during recent years. Much of this has been attributed to effective cooperation by owners of adjoining properties solicited by members of the field forces of the Railroad Fire Prevention Association and through the better control exercised by employees in elimination of fire hazards.

There is a reciprocation of action here mutually helpful to the railroads and their neighbors. Losses suffered by owners of adjoining properties have unquestionably decreased, probably in equal or

greater proportion than have those occurring within the right-of-way.

Not the least of the activities in this respect are those which have to do with forest fire prevention. Speaking now for the Baltimore and Ohio Railroad, with which I am associated, and from a knowledge of the operations of other carriers, it can be said that more effective action to prevent spread of fire to forest lands is now being taken than at any time in the past.

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- (6) Use of best methods of fighting fires as found most effective by Forestry Department officers.
- (7) Close supervision to avoid leaving deposits of hot coals and ashes on the right-of-way in territory of fire hazard, and to control any burning of combustible material so that the fire shall not be communicated to adjoining lands.
- (8) Posting of fire warning placards at strategic locations on the railroad property.

These and other measures suited to the conditions in various localities are being co-operatively applied by the representatives of the National and State Forestry Departments and the railroads.

A similar co-operation between the railroads and adjoining property owners giving more intensive application of these means of combating fire ravages promises most effective results.

In the provision of safety strips, the laws in states covering that requirement are such as to induce contact of property owner and railroad forces. Commonly those strips are no less than 100 feet from the nearest rail. More frequently than otherwise, it will be found that the right-of-way limit does not extend that far. Permission from the adjoining owner for entry on his lands to provide the needed protection is secured by State Forestry representatives.

As the owners of land are securing insurance from loss through the provision of these strips, there is seldom any objection to issuance of the permit. In fact, during the past two years on Baltimore and Ohio lines, I recall but one instance where permit was refused the State Department of Forestry, and but a few where any restrictions such as protection to specific pieces of property or special trees within the safety strip limit were imposed.

It is in the actual work of clearing these adjoining lands that railroad forces find their opportunity to show real co-operative neighborliness in the removal of a menace, damaging alike to the owners and the roads. It is also the opportunity of the railroad officer or employee to enlist the active support of these owners in the measures that have been found effective in prevention of forest fires.

The exhibition of the role of the "good neighbor" will enable the railroad employees to accomplish more in this respect than will any other action that I can conceive.

If there is wanton or negligent scattering of ashes or hot cinders, observation and report to responsible officer of the road will bring action to correct conditions. The neighbor as well as the interested employee can here assist.

If there is threat of fire caused by carelessness or maliciousness of employees or passengers on trains operating in regions of fire hazard, such as throwing burning coals, hot ashes, lighted cigarettes, etc., on to the right-of-way, the action of those neighbors or our own em-

ployees alive to the dangers of those practices will be effective when they remind those responsible of the holocaust that might arise as a result of their thoughtlessness.

To me it appears that our finest contributions to the prevention of forest fires will come through the co-operative efforts of property owners and our own railroad employees in education of all persons who in any way make use of the forests, whether it be for sport, recreation, utility, or as a facility for any purpose.

By calling attention to the need for care and interest in preventive measures either in conversation, or by distribution of printed articles, placards, etc., much can be accomplished. Immeasurably more can be done by calling attention to examples coming within the experience of those who are in the field and have the opportunity to observe and bring to the attention of a thoughtless user of the forest the need for his interest in prevention of fire. One illustration is worth a hundred orations. In this respect, our railroad field forces have exceptional opportunity to assist. Our neighbors are in an equally favorable position to help. Exchanges of counsel and opinion by residents of the communities and railroad employees, and action in every instance that may come under their observation to correct hazardous practices will serve in largest measure in the reduction of forest fire losses.

It will also be the opportunity to show that in this field too, there can be developed co-operative effort of benefit alike to individual, corporation and nation. (Applause).

CHAIRMAN DORWORTH: Mr. W. R. Lawrie, of the Duluth & Iron Range Railroad Company, Duluth, Minnesota, was scheduled to present a paper on "Forest Fire Patrol." Mr. Lawrie has sent in his paper, being unavoidably detained, and I am going to ask Mr. Wirt to read it.

Mr. W. H. KILBY: I would like to congratulate Mr. Cook on one of the best papers I have ever heard read by a railroad man or forest officer in a forest protection conference. He has covered every element, as we know it.

There is one point I would like to ask him, and any other railroad representative here. Have any of the railroads in the State of Pennsylvania a man whose duty it is to coordinate the efforts and spread uniform instructions and information within their own organization?

MR. C. C. COOK: I would like to answer that, particularly because I have a personal feeling. We had such a man, Mr. J. O. Potts, probably known to the Pennsylvania men in this room, who did do that duty for the B. & O., and I think it will be testified to by the forestry men in the room that he did that work most acceptably for our line. He fell ill about a year ago and it has been a loss to the Company, and a personal loss to me, that we haven't him for that

duty. It is our intention to have another man take his place, but for the present we are letting two or three district maintenance engineers carry on the work that he did before. But if I may say it, it takes a man with a peculiar knowledge of lumber and woods to perform that duty, and we have suffered a loss in that respect that we will simply have to, in some way, make up.

MR. W. M. BYRNE: I would like to remark that three roads in Minnesota have what we call railroad supervisors for that work. And I would like to commend it strongly to any railroad; it is a very important thing in the success of the work.

MR. W. H. KILBY: Mr. Cook made reference to the necessity for having a peculiar type of man—I suppose I may classify among the peculiar types. There is a certain mandatory knowledge, in fact a paramount knowledge, necessary, of the principles of forestry operations, and particularly with regard to railway operation within the railway organization in order to make that kind of work successful from the inside.

We have a man who has had the double experience of being on both sides of the fence, and we have found, as I hope to show you this afternoon, that the appointment of a special officer is a mighty good thing.

CHAIRMAN DORWORTH: If there are no further discussions along that line we would be very glad to ask Mr. Wirt to read Mr. Lawrie's paper.

MR. G. H. WIRT: Mr. Lawrie, I might mention, is one of the men who has been appointed by his road, the Duluth & Iron Range Railroad Company, to do nothing more than coordinate the forest protection work, and comes under the classification about which Mr. Kilby raised the question.

Mr. Wirt then read Mr. Lawrie's prepared paper on "Forest Fire Patrol".

The Duluth and Iron Range is primarily an iron ore carrier, running from the mines of the Mesabi and Vermillion ranges to the docks on Lake Superior.

The distances are short, the longest passenger run being 120 miles and the average ore haul about 65 miles.

Traffic is very heavy during the months in which lake navigation is open.

The country traversed is thinly settled. The original timber, which was mostly white and Norway pine, has been almost all cut, altho large swamp areas of back spruce, and some highland hardwoods and jackpine still remain. Practically all of the cut over country has been burned at least once, largely the result of the practice of burning slash with running fire which prevailed up to a few years ago.

These burned over areas produce a rank growth of wild grass and small brush, which dries out quickly during times of low humidity and creates a remarkable fire hazard.

Before 1911, railroad fire prevention in Minnesota was generally limited to the protection of railroad property only. In 1911, however, the State Forest Service was organized, under legislation giving it authority to require very intensive patrol. From 1911 to 1918, the railroads generally did just as little partolling and fire fighting as would get by the Forest Service demands. In October 1918, the great fires, with their aftermath of damage claims, suits and the payment of millions of dollars by the Railroad Administration, aroused the roads to the necessity of effective means of detecting and extinguishing fires, as well as accurate and reliable data on all fires, even those remote from any tracks. The fact that, in Minnesota, claims for property damage, by fire or otherwise, may be made at any time within six years, will explain the necessity for the securing and recording full data on all fires.

On the Duluth and Iron Range, the office of Fire Patrol Supervisor was created in 1920, and all fire patrol, fire fighting, including tools and equipment, fire records, mapping and investigation were placed under the Supervisor.

Patrol was continued by section laborers, except that a bonus of 5¢ per hour is paid for days spent in patrolling, over the rate for section labor. Section foremen select the partolmen from among their crews, generally picking the senior laborer. This selection is subject to the approval of the Supervisor. Patrol was formerly done entirely by hand speeder, but at present five motor cars are used on beats ranging from 10 to 20 miles in length. The rest of the line is covered by 10 hand speeder beats, varying from 5 to 10 miles in length. Several types of motor cars have been used and the more complete motorization of patrol is delayed only by the difficulty in finding what we consider a satisfactory type of car. Some side drive cars of moderate weight are used, but this type of car is not considered safe. The only center drive cars which have given satisfactory service so far are too heavy for one man to handle as frequently as may be necessary in fire patrol service. No matter what motor car may be eventually decided upon, we will probably retain at least three hand speeder beats in districts where heavy traffic, sharp curves and rock cuts make motor car operation dangerous at best.

Beginning in 1920, the fire records were carefully studied. It was found that more than half of the locomotive fires were started on a few short, heavy grades. Accordingly, partol beats were shortened up at these grades so several round trips could be made each day. The balance of the road was covered by two round trips daily, which has been found adequate.

For the four years 1920-1923 inclusive, we found an average of 64 locomotive fires each year. That is, sixty-four fires which started reasonably soon after the passing of a train. We have some reason to believe that a few of these 64 were cigarette fires, but they are all classed as locomotive fires. In 1923, the motive power department began to install $\frac{1}{8}$ " x $\frac{3}{4}$ " mesh netting in all front ends, in place of the $\frac{1}{4}$ " square mesh which had been the earlier standard. As a result of this change, coupled with very rigid locomotive inspection and maintenance, the average number of locomotive fires for each year 1924, 1925, 1926 and 1927 has been reduced to twelve. The total road locomotive miles during the six months May to October during which practically all fires occur, is about 675,000, which will make one locomotive fire for every 56,000 road locomotive miles.

However, we still find enough fires set on and near the right of way, by fishermen, hunters, berry pickers, highway crews, settlers and loggers, and by cigarettes thrown from automobiles on nearby highways, to justify the continuance and in some cases the intensification of the patrol system.

Patrolmen generally start from their beat headquarters about 9 A. M. Before that their time is taken up caring for their cars, tools and equipment. Patrol ends about 5:30 in midsummer and as early as 4 P. M. in the late fall.

Each partolman carries a shovel, canvas bucket, burlap sack and fire extinguisher.

For extinguishers, we have been using ordinary $2\frac{1}{2}$ gallon potato sprayers with inside pump, using plain water. With the nozzle reamed out to throw a straight stream of $1/16$ " to $3/32$ " diameter these have been found very effective in putting grass fires under control and in cleaning up hot spots in old logs, roots, etc. They are not of sufficiently rugged construction, however, for this service, and we are now trying out the standard "5 gallon" pump tank extinguisher,—except that, for ease in carrying over rough ground, they have been shortened about 4 inches and the capacity reduced to 4 gallons.

One of the neighboring roads has reported remarkable success with soda-acid extinguishers on grass and brush fires. Another nearby road equips its partolmen with heavy cotton mops, which, when wet, are said to be very good on small fires.

There are so many places where water is not available, however, that the common long handled, round point No. 2 shovel continues to hold first place as the standard first aid fire appliance. Upon discovering a fire, the partolman must first decide whether he, alone, can put it out or check it effectively. If not, he will go at once to the nearest section crew. All section crews, bridge crews, extra gangs, and other forces are under standing orders to leave any work

to give aid in fire fighting. Having summoned the section crew, the patrolman will proceed on his beat. On bad days, he may discover several fires and call different crews to each of them. Or, he may be fortunate in discovering each fire so soon that, with sprayer and shovel, he is able to completely extinguish it without undue delay.

With the help of the section foreman, the patrolman keeps accurate records of wind and weather, number and time of his trips, fires discovered, and the history of each fire—that is—whether put out immediately or burning for one or more days. These records are sent to the supervisor in weekly reports.

The section foreman makes a report, in full detail, of each fire on or near the right-of-way, on the same day it is discovered. If the fire burns over one day, a second or complete report is made when it is finally out.

The section foreman also makes a daily report of all fires observed burning at some distance from the track. These reports are especially valuable if a fire starting a mile or more away, continues to burn for several days and finally reaches or crosses the right-of-way. These reports are supplemented whenever possible, by the investigation of the supervisor or his assistant.

Here Mr. Wirt stated: That may be of particular interest to a number of railroad claim agents in Pennsylvania, because not infrequently we have reports of fires coming to us as having started along a certain railroad's right-of-way. And we get a reply from the claim agent, based upon information which he has received from his men, that the fire didn't start along their right-of-way but started two miles on the other side of the mountain and burned over the top of the mountain and down to their right-of-way.

So such information might be of considerable value to our railroads in Pennsylvania to combat the information which the State Department submits to them occasionally.

Mr. Lawrie's paper continues: The question of how far out from the track railroad fire fighting should begin has never been settled. In some cases it has been found advisable to take railroad crews upwards of a mile out to meet oncoming fires. In other instances, it has been sufficient to stop it at the right-of-way fence, or even at the edge of the ballast.

Of course, fires starting on railroad property are followed until extinguished, regardless of the distance they may travel. The policy of affording all protection possible to property, regardless of ownership or liability, is approved by the officers of the road and is generally followed.

To facilitate fire fighting, three portable gasoline driven fire pumps have been purchased, together with several thousand feet of $1\frac{1}{2}$ " hose. These pumps have only been required on a few fires but

have fully justified their cost. The road also maintains a fire train with 12,000 gal. tank capacity, steampump electric lighted, with both $2\frac{1}{2}$ " and $1\frac{1}{2}$ " hose. This train has been used to good effect on several fires, most notably in May 1926, when it saved the village of Knife River from certain destruction.

The work of the supervisor and assistant has been made easier and more effective by the construction of a headquarters building at a central junction point, where office and sleeping rooms are provided, and where all work can be quickly and conveniently directed. The equipment includes two automobiles, extra rail motor cars, spare shovels, pails and extinguishers, and a complete set of wind and weather recording instruments which are used to secure data on fire weather in conjunction with the U. S. Weather Bureau.

The supervisor and assistant, in addition to looking after all fire patrol and fire fighting, are expected to check all reports, make maps of all fires, keep in touch with the State Forest Service, other railroads and all other fire prevention agencies, issue permits for and supervise all burning of old ties, grass, etc., look after shippers loading forest products, etc. Since July 1926, they have also had all building fire prevention and fire fighting to look after.

This work has all entailed considerable expense, but it is probably fair to credit it with the fact that since 1920, the road has had to defend in court but one suit for damage from fire (and that one was defended successfully), and have paid out in settlement of claims only a few nominal amounts, where payment was made as a matter of policy and not in recognition of any liability in the matter. This can be better appreciated when it is explained that, after the 1918 fire cases, the collection, or attempted collection, of fire damages from Minnesota railroads bid fair to become one of the most profitable industries in the state. (Applause)

CHAIRMAN DORWORTH: The Chair observes in our midst a gentleman who is never obtrusive, but who is a wonderful supporter and advocate of forestry and who has been tremendous help to the Forestry Service of the Commonwealth of Pennsylvania.

He hasn't the faintest idea that I am going to ask him to get up and say a word of greeting, but I am doing it in acknowledgment of his wonderful service to the State, in appreciation of it.

That gentleman is Mr. Edward Bailey, of Harrisburg, whom I would like to get up and say "how do you do?" on the part of the State Forestry Commission to the representatives of the various railroads here present.

Mr. Bailey. (Applause)

MR. EDWARD BAILEY: This takes me entirely by surprise, but it is a very great pleasure to me, personally, as a member of the Commission, to see so many people here this morning, evidencing their deep interest in forest preservation.

I know that the railroads have heartily cooperated with this Department of recent years, and with a continuance of that cooperation I feel very sure that we may look to a rosy future. Looking at it from the standpoint that Mr. Cook just spoke of, a man who is competent to talk fluently on the subject could speak several hours in picturing the future of Pennsylvania when the forests of the state are properly handled. There has been a wonderful growth made in educating everybody in that direction, and it has been the aim of the Department to try and cooperate in every way with the railroads. And to me personally it is very gratifying, the response that has come from the railroads and from the private owners throughout the state, and as an individual member of the Forestry Commission I thank you all for coming here today. (Applause)

CHAIRMAN DORWORTH: We now would be very glad to hear from Mr. I. H. Schram, Erie Railroad Company, who will talk to you on "Railroad Methods for Promptly Reporting Fires Along Right-of-way." Mr. Schram. (Applause)

MR. I. H. SCHRAM: I want to express, Mr. Chairman and Gentlemen, my appreciation at being here at this Conference.

The subject assigned to me is not one on which a great deal can be said as it is only a small part of the whole subject we are here to discuss but it is a detail of importance and if this phase of the matter is not properly and efficiently handled the fire loss may be multiplied greatly. It can also be made to save the railroads a great deal of money for by promptly reporting it is possible to hold fires to a small area and reduce losses not only to State property but also to private persons and the railroad claims paid can be greatly decreased. Less railroad property is also lost. For instance not many years ago we had such a fire that destroyed a large number of stored box cars and grass fires annually do damage to fence and telegraph poles, burn up ties and have been known to destroy wooden bridges. On the other hand in the last year on our six divisions which have a portion of their line in Pennsylvania, we had but 34 reported fires in Pennsylvania although many incipient ones were extinguished with no reports.

I haven't the reports of the last few years, but I know that they are very much less than in previous years, and I find, in checking up your data, that these reports are a great deal in excess of what you have had reports on and charged us for. And so we feel that we are making some progress.

Of course all of this was not due to effective work in reporting and handling fires. A great deal of it was due to the better condition of the motive power as respects front ends and ash pans.

Most fires occur during hours that trackmen are employed and they are the men most readily notified at other times so that any

system of promptly reporting and extinguishing fires is based on their use although information may come through other sources such as train crews, State fire wardens or neighboring farmers. Where the danger is the greatest, systems of fire patrolmen have been developed both in this State and in New York and this has reduced fire losses to a low figure. The use of section foremen as special forest fire wardens, is also of considerable benefit as it impresses them with duties in this respect that it is difficult to do otherwise.

The fire patrolman is of most value in reporting fires when he is furnished means of getting over his section of track quickly. At one time it was our practice to have them walk track much as track walkers did, carrying a few tools to help put out the fire but we soon found that it took these men too long to get to a telephone to ask for help and that generally when a fire was found it was beyond the control of the patrolmen. We next graduated into hand speeders for these men which helped to some extent and we now are using motor cars with two men who are instructed to follow trains at a reasonable distance as much as possible and extinguish incipient fires. Generally one man stays at the fire while the other runs on his car to the nearest telephone to notify the train dispatcher and to summon help. The territory covered by two men on a motor car is about the same as they individually covered on hand speeders and on foot and it is our observation that on the lighter traffic branch lines generally single track that practically all trains can be followed. On busier railroads this is not possible but frequent patrols are obtained.

Where special patrols are not used section foremen and track walkers are valuable in reporting and fighting fires. The latter must walk of course and covers his territory but once a day, the foreman also rides over his section once a day but both of them from their local knowledge can distinguish the sign of fire and investigate, and take the necessary action.

The installation of telephone train dispatching on railroads has done a great deal to help this cause. In the old days of the telegraph which still holds on some of the branches, it was necessary for the alarm to be given from a telegraph office often many miles away. Some local phones to switches and outlying points existed but they were few in number. Train dispatcher's telephone systems give us a chance to have our men in the field talk directly to a central directing office. The train dispatcher, with his 'phone system, can notify trains, station agents and track forces. The train is used to carry messages from the dispatchers through the nearest operator to outlying section gangs and to notify them by sounding the fire whistle. The station agent also notifies section forces, and the local authorities and enlists their cooperation if necessary. The foremen in many

cases are equipped with portable telephones which are placed across the wires of the dispatching line and while these do not ring, rules require the foreman to frequently call in when he can receive information from the dispatcher and is notified of a fire. Where the telephone system is not yet installed, reporting is slower but news of a fire is transmitted by telegraph in much the same way, telegrams to the foremen to get to scene of fire usually being sent to them by passing trains. It is important and is impressed on field men that the central or dispatching office be notified promptly so that measures and facilities at his command can be used. Frequently the local authorities can be notified to give help, an engine equipped with extinguisher used or other prompt measures taken to limit the danger, for the real secret of success in preventing or limiting damage is prompt reporting and promptly sending help to handle the situation.

CHAIRMAN DORWORTH: The Chair is not sure that a representative of the Pittsburgh, Shawmut & Northern Railroad is here. If so I would like to be informed.

Then we will proceed to the next part of the program which is a talk by Mr. J. R. Prizer, Assistant Engineer, Maintenance of Way, of the Central Railroad of New Jersey, who will discuss "The Section Foreman as a Special Forest Fire Warden." Mr. Prizer: (Applause)

MR. J. R. PRIZER: Mr. Chairman: My vacation period this year is the first two weeks of December and it was scheduled to be spent in the woods of Carbon County, depleting, if possible, the hitherto unmentioned forest products, by one deer and one bear, but I have been a hundred per cent conservationist so far. Our party has however, I must confess, totally destroyed one bear and one white birch. I am holding this paper in my left hand as my right shoulder still feels the effects of the white birch and the bear load. However, the two days spent here has been very well spent and does not detract from the pleasure of my vacation.

With the advent of railroads about a hundred years ago the problem of keeping fire where it belongs, that is in the locomotive, immediately became of importance. The duty of perfecting, installing and maintaining devices to prevent fire from getting out of the locomotive became largely that of the mechanical departments of the railroads supplemented by the inventive genius of others actively interested in the prevention of forest fires. Just as naturally the duty of so clearing the right-of-way that locomotive sparks or fire-box droppings would be unlikely to start a fire and of fighting any fires which may occur became the duty of the local maintenance unit assisted by such floating gangs and outside help as may be available. The section gang is assigned to and works continuously on a comparatively short stretch of track, the section foreman is the leader of this gang and upon the interest, initiative and ability of the fore-

man depend to a great extent the condition not only of the track structure but of the right-of-way as well. The foreman as a responsible local executive is, irrespective of a reasonable amount of divisional supervision, in a position to completely fulfill or slight the instructions given him, and the policy of a management may be curtailed to some extent by a foreman who lacks the proper interest in or does not appreciate the importance of whatever work is to be undertaken. The importance of preventing forest fires and of fighting them, when they do occur, is well understood by foremen but it is probable that in many instances the section gang under the leadership of a man continually awake to the subject could at odd times devote somewhat more time to fire prevention work with but slight effect on their other duties.

At a meeting between State forestry men and representatives of various railroads held here in Harrisburg on May 4, 1920 it was proposed that section foremen in forest areas be appointed special forest fire wardens with their duties as wardens confined to the right-of-way and its immediate vicinity. The special appointment gives the foreman full authority of a warden as specified by law, it empowers him to call or compel assistance in suppressing a fire beyond the control of the force at his immediate disposal, to conduct investigations etc. But probably more important than the legal powers conferred by the appointment is the effect on the mind of the individual. In forest territory a section foreman is likely to be a man of considerable importance in the community and the position as a State fire warden may add somewhat to his prestige. While fire prevention and fire extinction are among the duties assumed with employment as a section foreman, a certificate of appointment as a special warden emphasizes the importance of those duties and certainly will tend to develop greater interest and efficiency along the lines for which the appointment was made.

Subsequent to the meeting of May 4, 1920 the question of special wardens was given consideration by the management of the Central Railroad of New Jersey, no objection could be discovered and the advantages were apparent. It was decided that there should be nothing compulsory about appointment so a circular outlining the proposition was sent to all foremen in forest territory and a request was made that they advise whether they desired to be appointed as special forest fire wardens. Those who replied in the affirmative were supplied by the Chief Forest Fire Warden with a copy of Form 75, oath of office, and Form 14, a record or application card for registering name, address, telephone number etc. Upon the filling out and return of these forms, certificates of appointment were issued and the appointee received a copy of the "Forestry Laws" and a copy of the "Forest Fire Warden Manual." The men were at the same time

placed in line to receive interesting and valuable circulars and pamphlets which are published from time to time.

Since the appointment of a number of special wardens we have not noticed and cannot conceive of any ill effects and we know they have added to the spirit of fire prevention and so accomplished much good.

Anything which can be done, no matter how apparently insignificant in itself, to lessen the waste and destruction due to fire is worthy of at least serious consideration. (Applause)

CHAIRMAN DORWORTH: This Conference has been very fortunate, I think, in having among its attendance, a gentleman who ranks so high that although he is not scheduled to speak at all I think we owe it to ourselves to call upon him for a few remarks. I refer to Doctor Herman Von Schrenk. (Applause)

DR. HERMAN VON SCHRENK: Mr. Chairman—I came here, gentlemen, to listen and not to talk. I am very much impressed, however, with the significance of this meeting.

I have never forgotten something that I read about the State of Pennsylvania some years ago, which was written by a very celebrated English traveler who had been all over the United States, and in the course of his discussion as to his impressions of the United States, he referred to a portion of the State of Pennsylvania in these terms. He said: "In traveling all about the world and in thinking over past experiences, nowhere was the effect of man's devastating hands on nature more evident than in the Pittsburgh district in the State of Pennsylvania."

I think that none of us can help but feel that the things which have been said, far better than I can put them, about the responsibility of the community as a whole in the conservation of our forest resources, have been no better put than was that remark by that Englishman.

In the early days, as has been stated here several times, when our forest wealth was very large and easily accessible, we didn't think it worth while to pay very much attention to it. I remember, some years ago, in a discussion on the desirability of conserving forest wealth, the economic question was raised as to why we should do so. And at that time some of us made some studies on the value of cross ties. I think those figures date back some eight or ten years now, but we made at that time a study of the value of the wood in the cross tie delivered to New York Harbor, as represented by the standing tree in Georgia. Those cross ties then cost us approximately \$1.05 apiece, delivered on the wharf in New York City. And in evaluating the various stages through which that cross tie had gone we figured that the value of the cross tie in the tree, before anybody had done anything to it, amounted to six cents out of that \$1.05.

Those conditions have, of course, changed somewhat, but the relative value in the tree is as yet insignificant when compared with the ultimate value of the material as we use it. It has been the history, however, of all materials, applying not only to trees but other things, that the initial value of the material as it stands, whether on top of the ground or in the ground, is only a small factor when compared with the ultimate value when it is finally used.

The forestry situation, however, has come to the point where the gap between the initial value and the final value is coming very close to us in the United States. As was said here by Doctor Oxholm, our researches in foreign lands have, in general, been disappointing. Sporadically we do get materials from foreign lands, but we have to concede that that isn't a very hopeful outlook.

Now I needn't repeat what has been said by others as to the interest which the railroads have in the problem of conservation of the forest supplies, which we still, fortunately, possess. I think the manifestation of the meeting such as this which you have called here, sir, is ample evidence of the fact that we are all interested and that we are doing a great many things.

Attention has already been called to the significance of conserving our cross tie supply. I made some figures for the New York Central Lines some few weeks ago, in connection with our studies of the amount of material used, and I thought you might be interested in my translating some of these millions of cross ties into acres.

Assuming that we get 60 cross ties per acre, and I don't want anybody to quibble with that figure because that is as good as anybody else's, (laughter), but assuming that we cut 60 cross ties per acre, in 1915 the New York Central Lines used the products of 116,000 acres of timber land for ties. In 1926 we used 65,000 acres for ties. That is a reduction from 116,000 to 65,000. To give you another comparison, in 1915 we used, for untreated cross ties, 58,864 acres. In 1926 we used 4,128 acres. In 1915 we used the product of 57,000 acres, which were treated, and in 1926 we used 61,000 which were treated. In other words we have cut our total consumption almost in half, and in the next two or three years we will be very much beyond that.

Now that, of course, is one evidence of the realization that we want to make material go further than it did before, and in that way add what we can in the way of conserving the remaining forest wealth.

I needn't say anything, I believe, as to the fire question. Sensible men resent any kind of waste whether it be in forests or other things, and the general attitude which was so well expressed by Mr. Cook, of a cooperative relationship between all classes of society, is growing in sentiment. It is growing in a way which to me is very interest-

ing, having made many studies of the attitude in European countries, with respect to the conservation of material.

In Europe, while it may not be safe to generalize, this is probably generally true. The attitude is one of governmental regulation. The Europeans, through long historical adaptation, if you may so call it, like to be told what they must do. I have never forgotten the reference of one of the Central European Railroad ministers when we got into a discussion many years ago as to the privilege of a person being on the railroad track. I had rather resented the fact that the police ran me off the tracks one day when I was looking at some tie-plates, and they wanted to put me in jail, although I had all kinds of credentials, they insisting that it was forbidden to be on the railroad tracks. I presented my story to the minister, and he said to me:

"What do you do in the United States? Isn't it forbidden to walk on the railroad tracks in the United States?"

"Yes," I said, "it is forbidden."

"Well," he said then, "what do you do?"

I said, "We walk there anyway." (Laughter) I told him that we were believers in individual initiative, that the railroads tell us it is dangerous to walk on the track and if we want to assume that responsibility well and good.

He said, "Well, we Europeans like to be told we mustn't do it and we like to have that enforced."

However, it is a very much healthier indication to take the attitude which we take towards life in this country, to make people do things because of their own initiative. Often times, to be sure, it is based upon selfish motives, but eventually those selfish motives are transplanted into motives of general good for the general public.

And I think the manifestation of a meeting of this character, in which we are all getting together with these expressions of mutual understanding, which come as a result of such a meeting, forms probably the most hopeful sign that the problems which we are all interested in are in a fair way of solution.

I thank you. (Applause)

CHAIRMAN DORWORTH: Is there any topic or any phase of the subject that any person would like to take up for information or informal discussion at this time? If not we will declare a recess until two o'clock this afternoon.

The meeting adjourned at eleven-thirty-five o'clock.

WEDNESDAY AFTERNOON SESSION

December 7, 1927

The meeting convened at two-ten o'clock, the Honorable Charles E. Dorworth presiding.

CHAIRMAN DORWORTH: I will now call the afternoon session, and concluding one, to order.

Announcements regarding registration, by Chairman Dorworth.

We will now take up the first subject of the afternoon, which is "Forest Protection from a Railroad Standpoint." This will be presented by M. H. Doughty, Division Engineer of the D. L. & W. Railroad Company. Mr. Doughty! (Applause)

Mr. M. H. DOUGHTY: Mr. Chairman and Gentlemen: When, in response to an invitation from Mr. Dorworth, the Secretary of the Department of Forests and Waters of the Commonwealth of Pennsylvania, Mr. Davis, the President of our Company, the Delaware, Lackawanna and Western Railroad Company, designated me to attend this conference, I was very glad indeed to know that I was to have the opportunity to meet with you gentlemen and to perhaps in a minor way lend a hand in the most meritorious work of devising methods and means of protecting and increasing the great forests of the justly famed Commonwealth of Pennsylvania—I remembered that the school geographies of my youth taught me that the name of the State itself meant "Penn's woodland".

In such a commonwealth, with such an origin and history, you do well to gather in conference, in an earnest effort to perfect every possible means for the security and the enhancement of your magnificent woodlands. A commonwealth having more than 40% of its area forest lands, certainly therein possesses a heritage whose proper care is worthy of the best thought of the best minds that the state can produce. And I have been very greatly interested indeed in discussions of this most important subject which have been presented by the speakers who have preceded me.

My own experience (extending over a considerable period of years) in matters pertaining to forests all took place outside of the State of Pennsylvania, and it has also all been from the standpoint of the user of the forest products. And it has never before been my privilege to know directly of your problems and activities here in Pennsylvania. This makes your conference here of unusual interest to me, while at the same time it compels me to appear as a layman only and not as an expert in your forestry problems.

The Company which I represent was at one time the owner of upwards of 100,000 acres of virgin timber lands consisting of long leaf yellow pine lands in Florida, and hemlock and hardwood forests in Virginia. We have also made extensive experiments in the use of South American woods for ties. From the bank of the Amazon River in South America, we had cut and shipped for experimental purposes a considerable number of ties of various tropical woods.

We are also one of the pioneers in this section in the extensive treating of ties and timbers for railroad use. In the States of New

York, New Jersey and Pennsylvania, where our line runs through forest lands we have cooperated with the States by permitting our track foremen to be appointed deputy fire wardens, by providing them with fire fighting apparatus, by thoroughly cleaning the right-of-way and burning rubbish at least twice a year and oftener when necessary. We have provided fire strips where property owners have permitted. Our responsible officers have given fire protection their very best personal attention.

I might say also that we are in close enough touch with these matters to know that you have a very live Department of Forestry here in Pennsylvania. As an instance showing this, I ran across a report from one of our investigators as to a certain fire whose origin gave rise to certain differences of opinion,—we pleading not guilty. Along down in the body of the report I ran across this somewhat naive expression: "It isn't much use to start an argument with these fire wardens, they are on the job every minute". I take pleasure, gentlemen, in making public this, perhaps unintended, tribute to the loyalty and efficiency of the rank and file of the employees of your forestry department.

The treatment of our forests is a matter of profound importance not only to the railroads, but to all of the people of the State and to future generations. This makes it doubly important that we should fearlessly face all the facts in order to prevent waste of effort and money—that we should keep our feet on the ground to the end that our energies are not dissipated in fruitless measures.

Money for public expenditures can be obtained only by some form of taxation. Even the comparatively small company which I represent, finds it necessary on the first of each month to set aside a sum of more than \$600,000.00 to pay the month's taxes. The carriers of the United States commonly pay more in taxes than they pay to their stockholders in dividends, besides largely policing their own properties. Gentlemen, this is a heavy burden, and we would like to believe that the money is expended in ways that will produce results that justify the expenditure.

At the risk, therefore, of seeming to be critical, I shall mention some of the ways in which, in my opinion, money should not be expended in forestry. In a country developing as rapidly as is this country, timber cannot much longer be permitted to stand upon lands that are suitable for agriculture. Therefore, the expenditure of funds for forestry should be confined to those regions unsuited to other purposes than the growing of forests.

In this country, wages are comparatively high—timber is comparatively cheap. Furthermore, the forces and activities of nature are so tremendous compared to the puny efforts of mere men, that it does not seem to me that we can afford to spend any large sums of

money in reforestation. Also, many of our best woods come from trees that are very slow growing. A hemlock, to be of sawmill size, must be perhaps 150 years old. 150 years is a very long time in the history of America. At the present rate of progress, many of the areas now devoted exclusively to forests will long before the expiration of a hundred and fifty years, be given over to factory buildings, offices or apartments.

Railroads have been accused of being the cause of many forest fires. Not speaking for any one railroad, but addressing the problem as a whole, it is clear that the substitution of electric power for the steam locomotives now used would at least make it necessary to assign some other origin to forest fires originating along railroad rights-of-way. I think there is at this time, particularly in sections where heavy grades are necessary, an attitude on the part of railroad men generally, distinctly favorable to electrification. In such locations electrification is, in my opinion, justifiable from an economic standpoint. In these circumstances, I believe electrification is prevented wholly by the tremendous capital expenditures involved and by the inability of carriers to obtain the needed money. If this is true, it is a matter that should be given due weight when matters of taxation for forestry or for any other purposes are under consideration.

In certain sections of the country, notably the Pocono Mountain region, the cutting over of timber lands seems in some way to change forest conditions, so that in many places it is doubtful whether, even with proper forest protection, the lands will again grow timber of value. This is a point which, in my opinion, is worthy of due consideration in deciding how and where to expend funds provided for forestry purposes.

It has been estimated that present day logging operations denude our forests at a rate equal to three times their probable rate of growth. Carriers have had this very forcibly brought to their attention in their efforts to find an adequate supply of suitable cross-ties for their tracks. Carriers continually are searching for new supplies and for means of prolonging the life of the ties in their tracks. In 1910, we, on the Lackawanna, began the extensive treatment of ties with creosote oil. Previous to that time it had been necessary to replace every tie in every mile of track upon the entire line in a period of eleven to twelve years. In 1910, a cut-off line was constructed, having 71 miles of track and requiring 214,000 ties. Of this number, in 1926, after sixteen years service, roughly 90% were still in the track doing good service, and apparently still good for a long period of years. For several years, by the use of treated ties, we have been able to keep tie renewals down to less than one hundred ties per mile of track per year, or about one-third of the former requirements. By this means, during the year 1926,

we were able to obtain our entire tie supply from regions tributary to our own lines. If it is true that the consumption of forest products exceeds forest growth three times, and if the treatment of ties will prolong their life to three times that of untreated ties, apparently as to that particular item the problem is susceptible of solution. When it is remembered that the tie renewals for the railroads of the nation require perhaps one-eighth of the merchantable lumber output of the country, the value of tie treatment may be recognized.

I therefore urge, as one of the most economically sound investments, the expenditure of such sums as may be reasonably necessary in the conducting of experiments looking to the perfecting or cheapening of the processes of timber preservation by treatment; also expenditures made in the dissemination of information already available upon this most important subject.

There has occurred recently in this country, a very marked change in certain basic conditions affecting our industrial life. Whereas in the past competition was between man and man, between one manufacturer and another in the same line, or between one railroad and another in the same territory—today competition, and of the very keenest kind, is universal between entire industries. The coal producers are in vigorous competition with the producers of petroleum for the favor and patronage of the public. The timber trades have organized nationally to fight the inroads being made upon their markets by the steel companies and the sheet metal trades. Automobiles and motor trucks have sharply cut into the revenues of the rail carriers.

Under these trying conditions, we do believe that if any special legislation is necessary, for the protection of our forests the utmost care should be used in the formulation of such legislative acts, to avoid the placing of an undue burden upon any one industry. Russia has perhaps greater natural resources than does the United States. Perhaps the principal reason for the vast difference in conditions in the two countries is that in America public affairs have been handled with more skill and wisdom. We plead for a continuance of that wisdom and skill in the administration of public affairs.

In conclusion: A recent bulletin of the Chamber of Commerce of the United States shows that among the thirty-seven states having important forest resources, Pennsylvania is well up among the states in the first division in the matter of expenditures for forest protection. I believe that there are two kinds of activity in forest protection which will pay returns; namely, fire prevention, and timber preservation by treatment.

I take pleasure in assuring you that from our Railroad Company and, I am sure, from other carriers, you may depend upon the most hearty and thorough-going cooperation, both in spirit and in act

in all suitable measures looking to the protection and enhancement of our forest resources.

I thank you. (Applause).

Governor Fisher entered the room at this time (The audience arose and applauded)

CHAIRMAN DORWORTH: Gentlemen of the Conference, it is an honor and a pleasure to present the Governor of the Commonwealth of Pennsylvania, the Honorable John S. Fisher.

GOVERNOR FISHER: Mr. Secretary, and Members of the Conference: As I look over your faces I am very happy to recognize many familiar ones.

I am not surprised at the generous and hearty response of the railroads to the invitation of the Department of Forests and Waters to join in the conference you are holding today. I have at least a limited understanding of your views on the problems you have met to consider, having been a number of years a railroad official myself and as such having had occasion to negotiate with the forestry officials on sundry matters.

I have glanced over the topics under discussion and observed the names of those who are down for addresses, from which it appears that there is a very general representation of the carriers of the State in this Conference. The presence of Mr. Hartenstein of the Lehigh is a reminder of former days when he and I served on committees coming to the Capitol to iron out some of the distressing difficulties with which the railroads were beset in times more trying than these.

The railroads have a very special interest in reforestation. They have been a strong support of the movement ever since it took form back in the nineties. It was as late as 1901 that the Legislature set up a separate Department to deal in a comprehensive and business-like way with the problem, since which time great progress has been made. I am not familiar enough with what has been done elsewhere to make exact comparisons, but I believe I am safe in saying that Pennsylvania is in the front rank of all the States in the value, extent, and scientific management of its forest domain. The Department in charge has been singularly free of anything savoring of the disreputable and today is functioning as one of the most vigorous and progressive activities of my Administration.

In days of lumbering activity, great forest-stripped areas were created by the ruthless axe of the woodman without any thought for the future, much of it within the memory of men still living. For the time, thoughtlessness and greed seemed to hold complete sway. Although it ought to have been perfectly clear that many millions of acres could never be used for agriculture, no seed bearers were left, and scarcely anything else above the size of a fishing pole.

The State has gradually been acquiring these wasted lands and aiding nature to repeople them with living trees. At this time the State forests comprise about a million and a quarter acres. This has been accomplished at a minimum cost. I am not in possession of the figures, but I am safe in placing them at less than three dollars per acre. So you see the bargaining has been pretty good.

This administration has reached a very definite point in the program of reforestation. It is some years since any considerable addition has been made to the forestry lands. However, the last Legislature, in conforming with the budget recommendations, appropriated in various ways a sum not less than a million and quarter to further additional purchases. Of this \$500,000.00 comes from the General Fund, \$450,000.00 provides for the purchase of the "Cook Forest", and more than \$300,000.00 is made available from hunters' license fees for the purchase of game refuges. Whether the lands be acquired for purely forestry purposes by the Forest Department or for game refuges by the Game Commission is immaterial, for they will serve the same general purposes. I can give assurance that through these two activities there will be an addition to the public domain of at least a quarter of a million acres before the close of 1928, bringing the total up to about a million and a half acres.

Very practical measures have been adopted to carry on the work. Secretary Dorworth has been fortunate in securing the services of Mr. Irvin Gleason, of Williamsport, to supervise purchases. He is an old-time lumberman of the West Branch with an unsurpassed knowledge of the whereabouts and value of desirable tracts. He is working in close harmony with the Game Commission in order to avoid conflict and rivalry. The main differences of policy of the two functions are easily reconcilable. In building up the forest reserves it is sought to group large areas and solidify them in so far as is practicable, while the game refuges are widely scattered to accommodate the sportsmen.

So you see the State is moving forward to bigger and better accomplishments in forest replacement. You who represent the transportation interests have above all others a direct interest in what is being done. You are interested in producing traffic. Trees, lumber, and tonnage form a natural sequence. You know that the destruction of the forests left a wake of disaster for what were known as the "lumber roads". As we travel over the good roads through the old-time lumber regions, we may observe numerous abandoned railroad lines whose decay is a melancholy reminder of neglect to give nature a chance to reproduce herself. The harm may be undone only by reproduction and a reversal of our former follies.

Your presence here is an earnest that the railroads are alive to their share of responsibility. Your cooperation is most valuable and

is highly appreciated, but you can do more. Tree growth is not the sole duty of the Commonwealth. It attaches to every owner of any considerable acreage of unused lands. While the railroads themselves may not directly own much surface lands, there are affiliated business concerns which do, such as lumber and mining companies. My suggestion is that pressure be brought to bear on such to induce them to engage actively in tree planting. I have in mind a coal company which took over, more or less unwillingly, many thousands of acres of surface along with its mineral purchases. After years of unprofitable tax payments and neglect, its attention was directed to the wisdom of fortifying itself with a future lumber supply. Now it has a fine nursery, from which it is planting at the rate of a million a year and is making a nice profit besides in the sale of plantings. I merely mention this instance in illustration of what can and ought to be done by many companies similarly situated, in supplementing the public efforts that are being made to reclaim the five million acres of denuded forest lands in Pennsylvania.

This problem appeals strongly to business sense. But it involves immeasurably more than the prospect of profit. It is freighted with a sense of duty to preserve and restore the pristine beauty of Pennsylvania's glorious hills and to preserve the purity and flow of her water sheds, not for us alone, but for the generations to follow. Let us with patience and faith project our works far into the future so that the silent forces of nature, through the flight of the years, may have opportunity to repair the follies that have been committed.

I thank you very much for the opportunity of meeting and addressing you all.

(The audience arose and applauded).

CHAIRMAN DORWORTH: The Chair would like to digress a bit from the program at this moment, and call upon one of whom we in the Department of Forests and Waters are justly proud, a man of whom Pennsylvania may well be proud and a man whom we will match against any man in the country in his line. I want to call upon Doctor Joseph S. Illick, State Forester of the State of Pennsylvania. Dr. Illick! (Applause).

DR. JOSEPH S. ILLICK: Mr. Chairman and Members of this important Conference: I am happy to meet with you this afternoon and want to express my regrets that I could not attend more of your interesting sessions.

It may be of interest to you, to know, that this meeting is held in the year that we are celebrating the Golden Anniversary of Pennsylvania Forestry. It was in 1877—50 years ago—that the late Dr. Joseph T. Rothrock began his historic Michaux Lectures in Forestry at the University of Pennsylvania. It is significant that the first educational efforts in forestry in Pennsylvania were made possible—not

by a Pennsylvanian—but by a famous French botanist and benefactor, who gave a legacy of \$14,000 to the American Philosophical Society in Philadelphia. A few years prior to Dr. Rothrock's death, he told me that at some of these lectures there was an attendance of as few as 10 people, and at none of them was the attendance large. It may help all of us to appreciate the progress that Pennsylvania forestry has made by contrasting the small audiences that Dr. Rothrock had fifty years ago with the audience of this conference, giving consideration not to the whole subject of forestry but just to one special phase of it, namely, the forest fire problems of railroads.

It has been my privilege to serve in State forestry work during the last twenty years. I am happy to tell you that the forester of today is being received much better than he was twenty years ago. Then he was looked upon with suspicion and generally regarded as a queer and visionary actor. The mildest interpretation of our early efforts was that forestry was a hobby, a pastime for sentimentalist, and created soft berths for those who wished easy outdoor jobs. I can illustrate this attitude by a personal experience. It was twenty years ago that I was given my first field assignment in forestry. I was asked to examine a group of trees that were not doing well in the upper end of Bucks County this state. The first thing that I did when I arrived at the grove of trees was to look up at the tree tops to see the leaves, for the leaves are, in most cases, the best means to identify the different kinds of trees. After making a general survey of the trees it occurred to me that the bark beetles might be damaging them. With this in mind I began scratching the bark of several trees. Then I thought that probably some root disease might be interfering with their normal growth, so I got down on my hands and knees and began to scratch the leaves on the forest floor. At some distance from the woodlot was a little store, and on a bench on the front porch sat the only spectator that I had while making this forest examination. I can now see that all these acts of mine, looking up to the tree tops, scratching the bark on the tree trunks, and working in the leaves on the forest floor, all appeared as queer and unusual acts for a normal man. After completing my job in the woods, I went back to the store and began talking with my only observer. He asked me many questions and looked at me with grave suspicion. The whole situation was accentuated by the outdoor garb that I was wearing. In color it was very similar to khaki, now very common, but then rather rarely worn. After being interrogated at length by this local man, I recall distinctly how he walked to a corner of the porch and spoke very confidentially to me in these words. "I am not going to squeal on you, but please tell me how you got by the guards?" (Applause). Apparently this man had in mind a nearby institution, around which there was a high stone

wall, with iron bars covering all the windows, and the inmates thereof wearing regularly a special brown khaki-like garb. In this way I began my career in forestry twenty years ago. I know too that everyone who served in forestry twenty or more years ago can recall similar incidents in the early days of his career. I am happy to tell you that a great change has taken place in the public attitude towards forestry. During the last two decades many worth-while things have been done in the forests of Pennsylvania particularly on the State Forests, that have won the general support of the people of the state. In 1898 the State of Pennsylvania purchased her first forest land. There are now in the State Forests more than 1,132,000 acres of forest land handled primarily for the production of forest crops, but also available to the people of the state for hunting, fishing and other forms of recreation.

Upon the State Forests are maintained 2,194 miles of roads, and 2,755 miles of trails. I am particularly happy to report that during the last year practically every mile of trails was mowed, and put in a serviceable condition for the protection of the forests. During the last year \$100,000 was made available from the Highway Appropriation for the construction and development of roads within the State Forests. In addition there was allotted \$105,000 for forest road work from the general appropriation to the Department of Forests and Waters. We believe that with the development of a good system of forest roads and necessary tributary trails we are going forward with a development that is fundamental to the proper handling of forest properties.

During the past year approximately 30,000 acres of forest land were acquired under an appropriation made by the last Legislature. With the \$500,000 appropriated by the last Legislature we hope to acquire approximately 125,000 acres of additional forest land. The maximum paid in recent purchases was \$4.00 per acre. A considerable acreage was purchased at \$1.75 and \$2.00 per acre. This shows that forest land is still available for State Forest purposes at reasonable prices.

I wish to tell you about one feature of the forest protection work of the Department of Forests and Waters that may not have been called to your attention. Because of the heavy expenditures for forest fire extinction work during 1926 it was necessary to ask the last Legislature for a deficiency appropriation. After the needs for forest fire extinction were fully presented to the Legislature a deficiency appropriation of \$100,000 for forest fire extinction was granted. It developed that the forest fire season of the spring of 1927 was the least destructive in the history of the Department. As a result of the light fire season and efficient organization of the fire fighting personnel, it was possible for this Department to turn back \$98,335.19

out of the \$100,000 deficiency appropriation. When this was done the Budget Secretary of the Commonwealth said:

"It was very gratifying to receive your letter of August 16, advising that there remained unexpended \$98,335.19 of the \$100,000 deficiency appropriation for forest fire extinction. I shall advise the Governor of your unusual accomplishment in returning more than 98% of a deficiency appropriation. I trust that other Departments will be able to report such extraordinary conditions, but I question if any can equal the record of 98%."

While it is true that practically all the forests of Pennsylvania have been cut down, I wish to call to your attention that there remains a great potential forest wealth. There are in Pennsylvania 110 different kinds of trees, of which not less than 60 can be classified as important forest trees. This is very significant, when we compare our forest tree wealth with that of Europe. I wonder if you have ever given thought to the fact, that the whole forestry practice of Europe is built around only 15 important forest trees. There are only three important forest trees in all of Sweden; the same number in Norway, and there are only three important forest trees in that great new Republic of Finland. They are: Norway Spruce, Scotch Pine and White Birch. In my travels through the forests of Europe I have observed that they have introduced many of our American forest trees in their forest practices. And while we are thinking of forest trees, I wish to remind you that the mighty oak gets its start from an acorn which develops into a tiny seedling that is usually not more than five inches tall at the end of the first year's growth. The giant white pine grows from a little seed that develops into a seedling that is usually not over two inches tall at the end of the first season's growth. The great hemlocks that formerly made up extensive forests in Pennsylvania grew from little seeds that developed into seedlings that were less than one inch when one year old. I believe that the most important message that I can bring to you railroad men today is to call your attention to the fact that every great forest tree and the most valuable forest growth that we can hope to develop in Pennsylvania must start from little seedlings. The low growth of forests often spoken of as mere "brush", includes tiny baby trees that will grow into forest veterans, if given a chance. If we permit this brush material to burn, these tiny trees will burn up with it. If we want mature forest stands, we must take care of the little baby trees in the forest. This is one of the important foundation stones of practical forestry. It is important that we understand that forest fires are very destructive to the young growth of the forest, and without the young growth we cannot have the older growth.

I am hopeful that the happy contact that has been established between this Department and the representatives of the railroads of

Pennsylvania will insure a continuance of hearty cooperation, and as a result of this I am confident that we will have better forests in Pennsylvania. I give expression to this confidence, for in my twenty years of work in Pennsylvania forestry there has never been a time when the outlook was brighter or the practices better than they are today.

I thank you. (Applause).

CHAIRMAN DORWORTH: We will now hear from Mr. Clyde Leavitt, Chief Fire Inspector, Board of Railway Commissioners for Canada, who will talk on "Some Aspects of Railway Fire Prevention in Canada." Mr. Leavitt!

MR. CLYDE LEAVITT: Mr. Chairman and Gentlemen: I assure you it is a real pleasure to have the privilege of attending this very fine meeting. I have learned a great deal from the papers that have been presented and the discussions that have taken place, and I am sure that everyone must be impressed with the spirit of cooperation that exists here.

I am here, as the Chairman said, as a representative of the Fire Inspection Department of the Board of Railway Commissioners for Canada.

We have approximately 40,000 miles of railways in the Dominion of Canada, and the Board of Railway Commissioners has jurisdiction over around 97 per cent of that mileage. The jurisdiction of that Board in Canada is somewhat more extensive than the jurisdiction of the Interstate Commerce Commission here in the United States. The Board's jurisdiction covers various activities in connection with the railways in Canada over which the individual states here exercise jurisdiction, and the railway fire protection work is one of the lines coming under the jurisdiction of the Board in Canada as to practically the entire Dominion, that is, as to the mileage of the railways under the jurisdiction of the Board.

Now in the earlier years in Canada the railways were very frequently charged with being a major source of forest destruction. There was scarcely a forestry meeting held at which one or more speakers would not get up and charge the railways with being responsible for more forest destruction than perhaps any other agency in the Dominion. The feeling became very strong and finally in 1909, the government of British Columbia applied to the Board of Railway Commissioners for an order to regulate the fire prevention work of the railway companies in the Dominion. Hearings were held in various parts of the Dominion; the matter was very carefully considered and discussed with the railway people and the government services, and finally, in the spring of 1912, an order was issued by the Board having this object in view. It was my fortune to be appoint-

ed to take charge of this new department of the Board and get it working.

This order of the Board broke new ground in several respects. There had been, in previous legislation, requirements as to the fire protective appliances on locomotives, but that was practically the only piece of legislation which really applied to the fire protection work of the railway companies. These regulations with respect to fire protective appliances were brought up to date and improved, after consultation with the railway authorities.

Also a new clause was inserted authorizing the Board's Chief Fire Inspector to prescribe such patrols to be performed by the railways as might be considered necessary by the Chief Fire Inspector. That was a brand new requirement. Any patrol work which the railway companies had done previous to that was entirely voluntary and for their own protection.

Then provision was made in this new order for regulation of burning operations on the right-of-way, the annual clean-up of the right-of-way, the burning of old ties, et cetera. It was provided that no such burning should be done except under such supervision as would prevent fires spreading beyond the strip being cleared, and it was provided further that the Chief Fire Inspector, or any authorized officer of the Board, might at any time place that work under the permit system, that is, no burning to be done except on a permit.

Provision was made also for the reporting of forest fire, not only to the officials of the railways but to the nearest forest officer, and requirements were inserted for the extinguishing of fires occurring along the railway lines, and presumably due to railway operations. One rather radical clause was inserted here, due to the trouble which had been experienced in previous years in determining the origin of fires. There was room for a great deal of dispute as to whether fires were caused by the railways or by other agencies, and a clause was inserted in the order which made the provisions relative to the reporting and extinguishing of fires applicable to any fires occurring within 300 feet of the railway track unless it could be shown by the railway that the fires were not due to railway operation. There was a great deal of feeling that that clause might work a great amount of hardship on the railways, but after about 15 years of experience with that, it is our judgment that it hasn't worked any very serious hardship, but it was considered necessary at the time to have that clause inserted in order to make sure, in the first place, that fires occurring near the railway would receive attention, subject to an arrangement that costs of extinguishing fires presumably due to some cause other than railway operation would be paid either by those responsible for the origin of the fire or by the government forest service concerned.

We find, in practice, that the government services cooperate very satisfactorily with the railways in that connection, although there are still occasional differences of opinion about the origin of individual fires. But the public service, or the public interest rather, is served in that connection, because the important thing is to get the fires out, and if the railway company or the government service concerned is occasionally charged improperly with the cost of the fire, that is perhaps not so serious as it would have been had the fire been allowed to spread without attention.

So I would say that the fundamental basis for this railway fire prevention work in Canada was, in the first place, the set of regulations promulgated by the Railway Commission. There was certainly a fear on the part of the railway officials in the earlier years that this order would be administered in an arbitrary and unfair way, and that the railway companies would be put to a great deal of hardship and unnecessary expense. I don't think I am out of the way in expressing the opinion that the fears of the railways in that connection have proved to a very large degree unfounded.

As a matter of fact this work has gradually been developed on the basis of a triangular cooperation between the Board of Railway Commissioners, the railway companies, and the Dominion and Provincial forest services in each of the different provinces.

I might say a word about the organization of our department. We don't have an outside field staff of paid inspectors on the Board's pay-roll, but we have developed a system of cooperation with all the forest services in the several provinces, the Dominion Forest Service in the prairie provinces, and the several forest services in the provinces which administer their own resources.

Take, for example, the Province of Ontario. Under our cooperation arrangement, the provincial forester of Ontario is given an ex-officio appointment as provincial fire inspector for the Board's fire inspection department; the district foresters are given appointments as district fire inspectors; and each chief fire ranger is given an appointment as divisional fire inspector. Those men carry on our local inspection work as part of their regular work. As a matter of fact this lightens their work since they would otherwise have to look out for fires along the railways if this tool were not available for them under which they can get very fine cooperation from the railway companies.

We do have a number of special inspectors for fire protective appliances on locomotives; that is a highly specialized line of work, as all railroad men will agree, and the ordinary fire ranger cannot do that properly. And I am personally of the opinion that it is better to go without such inspections than to have an amateurish or inefficient inspection. But we have a certain number of men whose

services are provided by the Dominion and Provincial forest services, who are thoroughly trained in locomotive inspection, and these men spend the entire fire season in this class of work, supplementing the inspections made by the railway companies' organization and the inspections made by the operating department of the Board of Railway Commissioners. So that we get a good many thousand inspections made each season in that way, and we have been very successful in unifying and standardizing the work of inspecting fire preventive appliances on locomotives.

We have found out from experience that not all men are equal, whether they are all free or not, and that not all the foremen in the round-houses are equally interested at the start in fire prevention work. So that at certain terminals we have found it something of a difficulty to get the men lined up on a really efficient basis. Their forces might be undermanned or perhaps they had a real lack of interest in the work, but at any rate while in many cases we had first class cooperation in other places that wasn't available at the start, and I certainly feel that for the inspection of fire protective appliances on locomotives it is a great advantage to have an independent inspection by some government service, so long as the work is done fairly and efficiently. It is our experience in Canada, and I am of the opinion, further, that a great many of the railway people will agree with this opinion, that an independent Governmental inspection on fire protective appliances on locomotives is very much in the interest of the railway companies themselves. They do not resent this inspection as they used to in the earlier days; they find it helps them in getting the standard of work on these fire protective appliances that the managements of course are anxious to have,—as anxious as the forest services are.

One of the things we have had to do is to make a careful examination of all the railway lines and classify them as to their condition with respect to forests. We find that approximately 35 per cent of the railway mileage of Canada is subject to classification as forested territory. Now under our regulations, and after the fullest consultation with the railway officials and the officials of the forest services concerned, we have worked out a system of special patrols covering approximately one-fifth of the total mileage of Canada.

Our standard system of fire patrol is by a selected member of each section crew on his section. We call that special section patrol, and we have that form of patrol in effect on approximately 4800 miles of railway. Then we have special patrol by special men on hand speeders on 836 miles of track and by special men on power speeders on 1800 miles. For the territory which is not subject to some form of special patrol we have what we call standard working instructions, issued by the management of the railway, covering the duties

of the employees with respect to the reporting and extinguishing of fires. Those instructions apply to all the railway mileage of the country, of course, whether the territory is forested or not.

In applying the Board's order and working out the requirements under it we have always made it a firm policy to consult fully with the railway officials in advance, so that we always have the railway viewpoint before we undertake to promulgate anything in the way of a requirement. In that way we avoid the impracticable and the unfair to a very large degree.

Now a word as to the results of this work. Mr. Wirt stated that in this state the percentage of forest fires by number corresponds approximately with the percentage of area burned, so far as the railways are concerned. In other words, if you have 35 per cent of forest fires in Pennsylvania attributed to railways, somewhere around that percentage would probably represent the percentage of area burned over by the railway fires.

Now we have, I think, a considerably more satisfactory showing than that in Canada. There is an occasional bad year when those percentages will correspond in some degree, but we frequently have it that the railways are charged with 10 or 15 or 20, or in some cases 25 per cent of the fires in the Dominion, but when we check up the areas burned by those fires we find usually,—not always but usually,—that the fires attributed to the railways have burned over two or three or five per cent of the total area, which, I think, is a great tribute to the work of the railway companies in connection with the prevention and control of fires.

Now we get a larger percentage of fires reported along the railway lines than we do in the country away from the railways. We have a double possibility of getting information there. The section forces are instructed to report all fires and those reports come to us. Then we have our local inspection and the whole fire ranger organization is more intensified along the railways than elsewhere, because that is where the towns and the businesses are to be found. So that we get a large number of very small fires occurring along the railway lines that might entirely escape attention in some other parts of the country.

But we find also that the working instructions with respect to the extinguishing of the fires are, in general, very well observed, and a large percentage of the fires are caught in the incipient stage and extinguished before they do any damage. That is not always the case, but usually it is the case, and where additional help is necessary in connection with a running fire the whole railway organization is available in case of need to handle it. The railways have, at dangerous points, special equipment. In the Dominion we have, for example a total of 24 fire fighting tank cars on the Canadian National

and Canadian Pacific Railway lines: These are flat cars with large water tanks mounted on them, and steam pumps and hose. These fire cars are moved by locomotives and operated by the steam power from the locomotives. These are provided voluntarily by the railway companies; there has never been any compulsion about it. It is a matter of self-interest and good public policy so far as the managements of the railways are concerned.

I might give you just a few figures on the fire losses attributed to the railways during the past two years. I don't want to burden you with too many figures and I didn't bring any great volume of statistics with me. In 1926, for example, on all the railway lines in Canada subject to the Board's jurisdiction the railways were directly charged with having started 926 fires. Of these, 786 were attributed to locomotives, and 140 to employees. These fires burned over a total of 46,000 acres, with a total valuation of about \$95,000. Those losses were mostly in the Province of British Columbia where they had a very bad season in 1926.

Now we all know weather conditions have a great deal to do with the fire hazard. During the past season we have been blessed with a reasonable distribution of rainfall and so this year we find that the railways in Canada are charged with only 383 fires, which have burned over a total of 3438 acres, with a total estimated damage of less than \$9000 for the entire Dominion of Canada. I submit that to you, gentlemen, as a pretty good showing for a country as big as Canada.

Now I have too much material here to present, and possibly there might advantageously be some discussion on some of these points. I would emphasize simply that it is possible for a government service and the railway companies to cooperate in a work of this kind, so long as you have the sincere interest of the officials in charge of the railways, as we have it in Canada; that the work can be administered in entire fairness to the railways and in such a way that the railways themselves take a tremendous pride in the fine showing that has been made by their organization.

Now in these earlier years the railway companies had to pay out year after year hundreds of thousands of dollars in damage claims, and there was a great deal of ill will generated on account of the frequently repeated charge that the railways were burning up the country. Well, now on the average the forest fire claims have almost disappeared. They have been so greatly reduced that I think it is perfectly fair to advance the argument that in that respect alone this fire prevention work has been a paying investment for the railroad companies, to say nothing of the element of good will on the part of the public which has followed as a result of this splendid cooperation provided by the railway companies.

I thank you. (Applause).

CHAIRMAN DORWORTH: It has been particularly interesting to hear from Mr. Leavitt as to how they are handling some of our problems in Canada.

We are now going to call on another gentleman from Canada, Mr. W. H. Kilby, Chief of Forest Protection, Canadian National Railways. Mr. Kilby will talk to us on the subject of "Forest Fire Education by Railroads." Mr. Kilby! (Applause).

MR. W. H. KILBY: Mr. Chairman and Gentlemen: I would first like to thank you, Sir, on behalf of my company, and personally, for the privilege of being here today, and to convey to you and your Department, and to the railways represented here, the greetings of the Canadian National Railways.

Now you probably have noticed a change in the order of the program. Mr. Leavitt and I should have this thing as a duet rather than as a solo, because he apparently holds a brief for the railways of Canada. Now I want to tell you that brief is more apparent than real, because, docile as he is in appearance, he is by no means as docile in his dealings with the railways, and we are only really good friends today because, for our part, we are not docile either.

Now I want to quote, or perhaps misquote, a saying of a really great historical United States citizen, who said: "All that I am, all that I hope to be, I owe to my mother." and I want to add to that, "and to Clyde Leavitt," because I shouldn't be standing here today but for Clyde Leavitt. And I am going to give this a personal touch, because, after all, we can only learn from two sources, from the experience and teachings of others, and from our own experience. And if you will forgive the conceit I might mention that my stock of modesty has shrunk to alarming proportions, and I will try and tell you my connection with forest protection from the inside of the railway, and I want, before I do that, to say that the whole success of this work is due, and I know Mr. Leavitt has heard me say this before and I am proud to say it again, to Clyde Leavitt and his wisdom and foresight in 1913 when he impressed on the railway officers of the then Canadian Northern Railways at Winnipeg, the value and necessity of having a man in the railway employ in charge of the organization of this work.

I wonder how the forest ranger—and I was a ranger in the Minnesota service at that time—the average ranger would feel being put in with a lot of hard hearted railway men, as I thought them at that time. My first thought was—how am I going to start this thing. I found out that I knew nothing, comparatively nothing, about the railway organization, and I found that the railways didn't give you a big staff; you had to paddle your own canoe or sink.

And so my first thought was to learn something of railway organization—and I want to say at this point that whatever you do in Pennsylvania or in any other state or province, you can't do it in forest protection unless you have a plan, some rules and regulations to go by. You cannot build a home properly or satisfactorily unless you have a concrete plan to work on. And that is where the regulations of the Board of Railway Commissioners, wisely thought out and wisely administered, have been our guide in our railway work from the inside of the railway.

In my work with a railway organization I first learned that I was a mighty small cog in a big machine, and if I may, Mr. Chairman, inject a little levity into this meeting—a laugh doesn't do any of us any harm—I would like to tell you a little story about two salesmen.

Dick said to Tom, "I did a fine stroke of salesmanship today; I sold a man 30,000 yards of material."

"You did;" said Tom "that was fine. Did he want the material?"

"Yes," said Dick.

"Did you have it?" Tom asked.

"Oh, yes, I had it," said Dick.

"Well," Tom said, "that was good business but it wasn't salesmanship. I did a bit of salesmanship today."

"You did, what did you do?" asked Dick.

Tom said, "You know the widow Murphy. Well, her husband was just buried and she wanted a black suit to bury the departed in, and I sold her a black suit and also two pairs of pants. Now that's salesmanship." (Laughter).

Now what is there behind that? It breaks the ice a little. It raises a laugh it is true, but just in this instance it teaches this moral, that to sell anything to an organization you want to sell it on business terms. Salesmanship can be carried too far, and you couldn't sell a railway an extra pair of trousers in reference to forest protection.

So I found that I had to go ahead and fit this little cog into the machinery. I found they were very human, sympathetic men, but I also found that railway men were essentially business men, and it didn't do to go to them with any ambiguous statements or any glorified suggestions, but to go to them with concrete statements and reasonable suggestions, that could be expected to work out satisfactorily.

In a railway organization, as the railway men know here, there are actually two forms of organization. There is what is known as departmental, and there is what is known as functional. Departmental, by the way, is controlled by the department, possibly from the system headquarters or from the regional headquarters, and all

instructions are issued from that department in a mandatory way. Functional organization brings the work down to a unit and to an individual, and in railways operating organization the division under a superintendent's charge, is the unit, and that was the channel that I had to go along with my forest protection canoe.

Now I might mention some figures. Figures are always interesting if you don't get too many of them. Mr. Clyde Leavitt showed you the remarkable results secured by the railways of Canada, and they are truly remarkable when you consider the climate of Canada and the miles traversed. The Canadian National Railways has something over 22,000 miles of track, a little more than 20,000 in Canada and about 184, I believe, in the United States. Nine thousand miles of those traverse forested territories.

Now what is our interest in this work of forest protection? I am going to state this and state it most emphatically, with the full support of my railway behind me, that our interests and our very existence are inextricably bound up in the preservation and proper use of Canada's forests.

In 1925 we purchased, and I will give you the exact figures, \$13,859,469.96 of forest products. We included in that amount rather more than the usual yearly supply of cross-ties, namely 9,826,970 cross-ties. We got some on hand that year to creosote and carry in stock. It is rather interesting, and a slight digression at this point, to note that in twenty years the cost of ties has risen from forty cents per tie to \$1.53. We transported forest products in their raw and manufactured state, in 1925, to the amount of 9,515,143 tons, or 17.28 per cent of the total freight of the Canadian National Railways.

Now that covers two lines of interest. A third, the value of tourist business in Canada is very hard to estimate, but at one point, Jasper Park, despite the fact that we have a big hotel and numerous bungalows there, we did not have sufficient accommodations for the tourists, and Canada is becoming more and more a holiday place, especially for the folks from the United States, and our forests are the greatest attraction for our tourist business.

Now I am just hitting the highspots. May I just read from an article on our Railway's forest protection work, which appeared in the British Empire Forestry Journal. It goes on to say:

"Forest protection with the Canadian National Railways is not regarded as a fad but as work to be undertaken as seriously as the movement of trains. It has always appeared to the writer that the majority of foresters outside of Canada have not yet fully realized the important connection between a company's forest and its railways, and in our own case it can be said that

our interest is second only to those actually engaged in logging and other mill work."

I read that because that is official and has appeared not alone in the Journal mentioned but in a number of other publications and newspapers.

So we are not afraid to take a stand on this question. Everything in the organization, as I got along with the railway and learned a little more about it, everything that was done had to have an educational value. It wasn't enough to issue these working instructions which Mr. Leavitt mentioned, and just in cold blood say to a man, "That is your job." It was necessary to have that individual, no matter how high or lowly he might have been, take an individual and personal interest in the work of forest protection. He wanted to know and we wanted him to know why he put out a fire.

We have, probably, a happy situation in some respects, in others possibly not quite so happy. We are, as you know, a publicly owned road. Canada's forests are approximately 85 per cent publicly owned. So we are in that position of being able to tell an individual that when he burned up this country, this timber, he was robbing himself. It was just a question of psychology.

I know that all of us are human enough that if there is a fire down our street we would button up our coats and say, "Let's go." But if it is our house that is on fire we get a taxi or run, because we have an individual interest in that property.

Now it is very interesting to see what the president of our railroad sent out over his signature. This is a personal message from him, and his thoughts on this matter.

"It is my personal desire that as members of the Canadian National Railways, and as citizens of Canada, you pay heed to this appeal and use every effort to further the cause of forest conservation. Proper use and restoration of our forest wealth is a matter of vital importance, and every stick of timber wasted, whether by fire or other agencies, is an economic loss which cannot be replaced."

When the president of a railway has confidence enough in this work to issue a statement like that it follows that the section man and the clerk is going to say that if that is good enough for my president it is good enough for me.

To create individual interest was the first step in education, and it has been described as the development of a forest consciousness. You can't get results in any line of endeavor unless you are personally imbued with the worth of that endeavor, unless you have a personal interest and give your very best effort to it. So before we began any mandatory or instructional effort we commenced a sys-

tem of education. That that system was the right system is proven by the figures Mr. Leavitt submits to you.

Of course it was necessary to introduce certain new measures. One new measure which is of interest, I believe, to railway men, and hasn't been mentioned here today, was the giving of merit marks for good work, and demerit marks, for failure to perform good work in the case of fires.

As I said, it is necessary to record fires because it isn't much use continuing to put out fires unless you know what causes them. So the first thought in reports had to be educational too. Of course we knew in a general way that locomotives started so many fires, so many per cent; we knew that the section man started so many per cent, but we didn't know very accurately just how many per cent, and we didn't know very accurately just why that locomotive started those fires or why that section man did.

So it was necessary to tear apart and build up a new reporting system, and the system we have has been referred to by governmental officers as a fool proof system, and if I may—and if I am too long Mr. Chairman just throw me off the platform—I will just explain this system.

We have in the railways, as railway men here will bear me out, a practice of making graphic charts for explaining the functions of departments or even of reports, and while this (indicating) is very small I will be glad to pass it around or give you copies of it if you care to write me. We developed this fire reporting system and showed it by means of this graphic chart. It shows the passage of a report from a fire to the headquarters office in Montreal, and to every individual employee or officer in between that fire and the headquarters office.

Fires don't wait. They don't say, "Now if you will wait until night time, Mr. Section Man, the wind won't be quite so strong and you will put us out a bit easier." You have to get at them right away, and you haven't time to argue who started it or anything else, because the potential business of a railway, particularly when forest land is adjacent to its tracks, is timber, so our first thought was and is, to put the fire out. We cut out all red tape and we prepared a little notice (indicating) and put this above every telegraph operator's key. This notice empowered that operator, without any request to a superior officer, to telegraph direct to the nearest forest officer, and at the railway's expense, because we believe that any uncontrolled fire destroys possible immediate business and undoubtedly potential freight or other business of the railway.

In addition to this departure from red tape it is necessary to determine cause, and for legal reasons, perhaps, to build up a record of every fire, no matter how small, and that is another point. We

do not care if a fire is only as big as your hand, if it has started, then, quite evidently, there is a cause for that fire, and we want to know what caused that fire because that little fire can become a big fire. This report (indicating), I know you can't see it from where you sit, is a symbolized telegraphic report. The reason it is symbolized is for speed in telegraphy. The information called for actually shows the condition of the fire, whether it is out, whether the present labor can handle it or not, or whether more labor is needed. And that is sent to certain officers who are the immediate officers to deal with the situation.

Every form carries on the bottom of it full instructions as how it shall be handled, and is carried by every telegraph office, every section man and every train conductor. The first issue of that form, I might mention, was something over 100,000, so in my position I had to have a little confidence in it when I told the railway company that we had to have 100,000 of these forms, because they don't pass an order like that unless you can justify it. Everything is on that form that was necessary to build up the history of that fire.

Now that was followed by what is called a tumbler form, and you will notice that these forms are on thin paper and on the top of both forms it says, "For the information of the Company's Solicitor, and his advice thereon." That simply makes the form privileged and protects the company from the use of the information contained in it by outsiders, in legal claims or for any other reason. This form (indicating) covers practically everything that can happen at a fire. It gives all the information that we may require for the Board of Railway Commissioners, or for provincial laws, or for our legal, mechanical and operating departments, and it is filed from the top and carries over in that way, (indicating). The instructions again are carried at the bottom of the form.

In compiling the history of a fire those two forms go together. But continuing the history of the fire through these forms, there may have been a loss there. There undoubtedly has been a cause. They are followed up until we have determined, with as much accuracy as is humanly possible, the cause of each and every fire.

In the event of loss, and I am pleased to say that fire claims are very much the exception rather than the rule—quite a reverse condition to 1910 or 1918, when, in 1918 there was the Whiteface fire and other large fires in Minnesota and the railways were held jointly responsible to the tune of about \$63,000,000. I don't think that can ever happen again. The investigations were made subsequent to the fire rather than at the time, and were not of much value, and everybody was handicapped as the result of making the investigations some months later. We are not handicapped that way now.

Now I think that will be enough about reports. I will be very glad to pass any of these forms around if they are desired.

The subject is so large, and personally I am so keenly interested in it, that it can't be covered in 15 minutes, but I will just with your permission Mr. Chairman, take about three moments on the aesthetic side of education.

Railroad men are no different than other men. They have interests as human as every other business man, and that is a point to bear in mind, and that appeal through the sentimental channels, as citizens of their country, is a real appeal. And they will go as far as their financial and other circumstances will permit in this work.

I would like to quote in that connection the words of Ruskin, and to leave this thought with you in this Convention today:

"God has lent us the earth for our life.
It is a great heritage.
It belongs as much to those who are to come after us
As to us,
And we have no right,
By anything that we may do or neglect to do
To involve them in unnecessary difficulties
Or deprive them of benefits which are theirs by right".

And Mr. Chairman and Gentlemen, if we have achieved any success in Canada in this work it has been through the cooperation of each and every individual, not alone in the railways but in the government services with whom we deal.

I thank you. (Applause).

CHAIRMAN DORWORTH: Owing to the lateness of the hour and with two additional subjects still to be discussed it is believed wise that we take the communication from the Public Service Commission, Albany, New York, on the subject of "State Regulations for Forest Fire Prevention," which we otherwise would read, and have it recorded as a part of the proceedings.

Paper by C. R. Vanneman, Chief Engineer of New York Public Service Commission on "Forest Fire Prevention" is inserted here in place.

In 1908, the legislature of the State of New York passed a bill which became Chapter 130 of the laws of 1908, in section 72 of which the following appeared:—

"The public service commission must upon the request of the forest, fish and game commissioner, and on notice to the railroad company or companies affected, require any railroad company having a railroad running through forest lands in counties containing parts of the forest preserve, to adopt such devices and precautions against setting fire upon its line in such forest lands as public interest requires."

The Forest, Fish and Game Commissioner made such a request and a series of hearings followed, out of which proceeded the order of the Commission dated April 1, 1909, an order which stands today in substantially its original form.

It should be made clear that this proceeding applied exclusively to the forest preserve, and hence to the railroads operating therein. So it is that the order applies only to locomotives operated through or in such preserve. The jurisdiction of the Conservation Commission, successor to the Forest, Fish and Game Commission includes such forest preserves, and it is clothed by law with administrative duties concerning what may be done in such preserves.

There are two districts which are affected, viz., the Adirondack and Catskill districts. At the outset it became apparent that consideration need not be extended to all the railroads which were physically situated within the limits of the preserve, since the forest conditions prevailing were obviously such as not to demand the serious consideration required by those which passed through or into the heart of the forests. Hence, the order specifically addresses itself to but three corporations, which have been operating under it, and as the Commission believes successfully, though at times under what appeared as reluctance. The wisdom of the order has been fully demonstrated and repeated attempts to have it modified have met with positive refusal by the Commission.

The hearings demonstrated that forest fires originating near or on railroad rights of way could be attributed successfully to poor maintenance of front ends, inability to maintain proper front ends, poor ash pan design, poor maintenance of ash pans, carelessness of engine crews in handling clinkers, littered rights of way, slash on adjacent lumbering operations, lack of patrols, and by no means the least to careless disposal of cigar and cigarette butts.

It was demonstrated that during the night hours there was substantially no danger from fires even in the so-called dry months. Hence, it was the conclusion of the Commission that to eliminate fires due to the operation of railroads it must address itself to the removal or prevention of the known causes. Obviously, it must confine itself to the railroad corporations exclusively. Therefore, after careful study and the examination of considerable data, it made the above mentioned order, which required the following:—

1. Complete installation of oil burning upon locomotives operated within the Forest Preserves in the Adirondack region between the hours of 8 a. m. and 8 p. m. to take effect not later than April 15, 1910.
2. A period of oil burning from April 15th to November 1st, which is the same as that prescribed by law for the Raquette Lake railroad.

3. The oil burning period may be shortened on application to this Commission, and on notice to the Forest, Fish and Game Commissioner, in years of minimum fire risk.

4. At least two locomotives on the Mohawk and Malone and two on the Delaware and Hudson to be fitted up with oil burning apparatus and placed in service not later than July 5, 1909, and maintained in service until at least November 1st.

5. The use of coal burning locomotives properly equipped and which have been inspected and certified to by the Commission, permitted between the hours of 8 p. m. and 8 a. m.

6. The inspection of coal burning locomotives which are to be used within the present year.

Following this order the Companies affected made arrangements to change their equipment to meet the requirements of the order, and did a vast amount of work in cleaning up their rights of way. Since that time there have not been any fires of consequence. Those which have been reported have been small grass fires, and their cause has been seldom, if ever, proven to be the result of the operation of a locomotive.

Obviously with a fluctuating oil price, and especially during the war period, the corporations have been confronted with the increased expense of operation, not to mention the annual expense of changing equipment from coal-burning to oil-burning and back again. Powdered coal was tried for some time, and while it seemed to meet all requirements in so far as the prevention of fire was concerned, it failed to prove successful from the operating stand-point. Later, with continued improvement in the design of ash pans and the development of special front ends, notably that known as the "Mudge-Slater", an effort was made to substitute such for oil. A trial was had, and while these devices generally seemed to be satisfactory, the Commission never believed it wise to eliminate the oil-burning requirement. In this it was always supported strenuously by the Conservation Commission and its Division of Forests.

The work of inspection outlined in the fifth paragraph above quoted lead to the development of a type of front end and a system of maintenance which the Commission believes adequately serves to prevent any fire from the locomotives reaching the right of way, and certainly adjacent lands where the right of way is at least 66 feet wide and the railroad single tracked.

There are no special features in the front end—it being that commonly referred to as the Master Mechanic's front end. The Commission inspectors make a detailed examination each spring before the oil-burning period arrives of each locomotive to be used as a coal-burning locomotive in the forest preserve. The purpose of this in-

spection is to see that the netting is absolutely secure, that there are no cracks around the smoke arch, the table plate, or the exhaust tip through which cinders larger than the apertures in the netting might find their way. This inspection is followed by daily inspections of the railroads' round house staff, and by periodic inspections of the Commission's inspectors as well as those of the Conservation Commission.

The cast steel ash pan has solved this phase of the problem most successfully. The Commission found it necessary to require that the sides of such should be carried up not less than one inch above the bottom of the foundation ring where such ash pans extended outside the ring. This has been opposed by some roads outside the forest preserve upon the locomotive on which the Commission has suggested its use, claiming it interfered with proper fire cleaning. This contention has never been supported by proper proof. On the contrary, the representatives of the Commission know that with but little difficulty a fire may be successfully cleaned. It is also clear that the use of this type of extension on the ash pan has prevented fires.

It is clear that there are many fires occurring annually on railroads in rural as well as in forest areas which can directly be attributed to railroad operation. The Commission's experience is that with but little additional maintenance cost such fires may be almost completely eliminated. There is no reasonable excuse for the belching of showers of sparks such as are occasionally seen when a locomotive is operated under heavy load and full throttle. Observation of details, good mechanical work at the time of installation and above all frequent and effective cleaning of front ends will go a long way towards completely removing this source of danger.

The fires resulting from ash pan troubles can be likewise minimized by good design, proper maintenance and the education of employees. A careless fireman can easily negate a vast amount of care and expense applied in the round house or back shop.

What to do with the cigar and cigarette source of danger is indeed a problem. It has been met in the forest preserve by the installation of screens but it is not infrequent that a careless traveler uses the door as the means of disposal and if the car is not tightly vestibuled or should the vestibule be open or be opened by the traveler, a fire may result.

The Commission is certain that the work done since 1909 has paid vast dividends in preserving timber and preventing unsightly scars on the face of nature. It seems to be obvious that that which has been done in New York can be accomplished elsewhere, in fact it has been done. While the fire loss in other than forest areas may at first glance appear to be small, and may be for all of that, nevertheless

it is an economic loss, and no one possesses the right to destroy ruthlessly or wastefully the property of others.

A coal-burning locomotive can with reasonable care be made safe for operation in substantially all territory, but until it is clearly demonstrated that the maintenance is beyond criticism, there must be eternal vigilance on the part of those entrusted to the preservation of our forests. Should it not go farther and extend to the whole countryside through which the railroads pass, especially in the rural areas?

CHAIRMAN DORWORTH: It is my pleasure to introduce to you now Mr. J. V. Neubert of the New York Central Railroad Company, whose subject is "State Regulations for Forest Fire Prevention".

MR. J. V. NEUBERT: Mr. Chairman and Gentlemen: I think this subject has been pretty well covered by your distinguished Governor, and others. In fact what I am going to say may be pretty much of a repetition of what you have already heard.

It reminds me of the story of the girl who went to the priest for confession.

He said, "Why Mary, what are you doing here?"

She said, "You know little Johny Jones?"

"Yes," he said, "I know him very well, he is a fine boy."

"Well," she said, "Johnny Jones kissed me."

"Well," said the priest, "That isn't so awfully bad. How often did he kiss you?"

"Father," she said, "I am sorry but I came here to confess and not to boast." (Laughter)

So any remarks that I may make with sincerity may be only in the spirit of confessing conditions, and in no way boasting of them. And, in referring to the New York Central Railroad, if I may be permitted to say it, I think that my remarks will also be applicable in whole or in part to the railroads of the State of Pennsylvania.

All of the very interesting papers which have already been read and discussed touch in a greater or less measure on the subject which has been assigned to us, that is "State regulations for forest fire prevention". No more interesting subject to the railroads is before them today than the question of forest preservation and forestation. Their supply of ties alone, requiring as it does, a product of thousand of acres per year, for use in that way, is one which has received intensive study and is receiving increasing attention from year to year. The destruction of forests or parts of forests by fire, whether such fire originates on the railroad right-of-way or not, whether such fire originates off the railroad right-of-way, and after extending to that right-of-way, is blamed upon the railroad, is one which must receive increasing attention.

Experience has shown that so far as fires set by railroads along their right-of-way are concerned, the railroads can do much to eliminate the cause of it. The fundamental necessity is careful maintenance of locomotives and we are glad to say that the standards of maintenance in that respect were never so high as they are now. With that standard of maintenance and with cooperation from state authorities in the way of great care in preventing fire in their own forests and in preventing accumulations of dry inflammable material, we believe that much can be accomplished, and even more can be done with the cooperation of the state authorities in bringing such pressure to bear as they can upon the owners of property adjoining railroads and suggesting inflammable material be not left near the rights-of-way and that more care be taken not only to prevent fires, but to prevent the spread of those fires which must necessarily be set at times by farmers to dispose of waste material or by others who build fires for necessary purposes with which no fault could be found, but who do not take sufficient care to see that their fires are protected or extinguished when their purpose has been served.

The reason we stress cooperation rather than rigid regulation is that state regulation, as such, is usually accomplished either by statute or by rigid rules promulgated by virtue of statute through the proper State department. A statute is necessarily rigid in its terms and rigid adherence must be had to those terms. Quick or elastic action under a statute is impossible, and while such action can be more speedily had under rules than under statute, nevertheless the rigidity is still there. Our sincere belief is that more can be accomplished through intelligent cooperation than through statute or rigid rules.

In this same connection the New York Central Lines, in their specifications for cross-ties and switch timber, inserted a clause in all these specifications, under the heading "Prevention of Forest Fires," reading as follows:

"The New York Central Lines call attention to the great loss of lumber resources occurring annually through forest fires. Everyone should cooperate to prevent the starting of such fires, and in suppressing them when started. The various forest fire laws should be rigidly observed and fire fighting organizations supported. Lumber producers and consumers are equally interested in this important matter, and should unite to create a strong public sentiment for the protection of our growing and developed forests against destruction by fire."

We heard some interesting talk yesterday on conditions in this country and in Europe. I thought that I would briefly express conditions existing in the New York Central Lines for the years 1915 to 1926, inclusive. The average number of ties used, for the

8500 miles of railways, was 1,480,252. With the conservation in the use of treated ties our estimate, for 1928, is 1,250,000. The average for the State of Pennsylvania, for 1915 to 1926 inclusive, was 283,205 for the 12 years. Our budget for 1928 is 168,000, a reduction of approximately 125,000 ties. That same corresponding reduction reflects in bridge ties as well as switch timber. Of the figures given you we averaged from 1915 to 1926 inclusive, approximately 230,000 ties secured along our own right of way in the State of Pennsylvania. Now that it is diminishing, it was a little below the average of the ties prior to the introduction of treated timber, but it is far in excess of the ties we will use in our present program with the preservation of timber in that territory.

With respect to the railroads that don't have forests along their right-of-way in Pennsylvania I wish to say that it is almost impossible for them to secure ties within the State of Pennsylvania. My predecessor said that we would never be able to treat the good old hard oak of Pennsylvania because you never could get any preservatives or substitutes to equal their life. Statistics have indicated differently, and we analyzed this condition and found within the years 1910 to about 1919, inclusive, that the average tie renewals with that good old raw-boned local tie, we were installing in the neighborhood of 280 ties per mile. The result was, whether it was virgin timber or otherwise, we put ties all in the treatable class, with the result, as I have told you, that our tie renewals for 1928, instead of being at the high average per mile, in 1928 will be 160 ties per mile, and we feel that as we increase toward getting 100 per cent treated material in the track, that that will go down in the neighborhood of 100, or some factor about in those limits.

Taking in a larger territory, and showing that this wasn't carried out alone in Pennsylvania, on the system lines of the New York Central, including the Rutland, in the year 1915 the ties used, in round numbers, were 3,430,000 treated ties, and 3,531,000 untreated. The total was approximately 7,000,000 ties, which gave us an average life renewal in all tracks of ten and eight-tenths years. Within the cycle of twelve years, 1915 to 1926 inclusive, we used 3,685,000 treated ties, and 249,000 untreated, on a total of approximately 4,000,000 ties, a reduction of 3,000,000 ties, which gave us an average life of 22.2 years, which practically made a reduction of 42 per cent.

Now that is characteristic of other commodities. There was discussed yesterday, the matter of certain European practices. I think one of the most extreme conditions existing in Europe exists in Great Britain, and I will describe what I mean. Take for example their cross-ties. After their ties are received and treated, in the course of about ten years they take those ties out and reclassify them

for further use, and they are first reclassified for first track service, then for second track service, and finally for minor track service, and much of that classified for minor track service goes into other material. And they saw that material up into fence boards, and so forth, and as one of the speakers yesterday also said, they sell the sawdust. Now then, the result of that is that their material condition in Europe is far ahead of the material condition or prices in this country, so using the slang expression, they have to conserve material and in a measure waste labor. (Applause)

In America the average condition, prior to about 1917, of cost of maintenance of way expenses was between 54 and 56 per cent labor and the balance material. Up to and through the war, and a few years afterward that condition developed whereby the labor went from 61 to 67 per cent, and the balance material, which indicated to the railroads that in some way there must have been waste. So with conservative conditions they wanted to get back to the original average, and they have gone to the conservation of material and labor and have reapplied conditions. I am referring to the cross-tie, applicable also to general conditions, whereby they have cut that balance back.

Now then we are talking about the conservation of the tie. That is only one factor, and you gentlemen look at that factor where a railroad man looks at both. Service spells money, and in order to earn that money you have to have the application of labor with its material. Now we want to conserve that tie, but when we conserve that tie what do we do? We gain what we are after, labor, and that labor in applying ties, saves us one man's hour, and in 1926, with the system lines, that represents 4,000,000 man hours.

I made the statement sometime ago that there was a labor saving of eight per cent in man hours as a result thereof. You must realize and appreciate that the greatest mileage of railways that we have had in the United States, was in 1915 or thereabouts, 255,000 miles. In 1924 or 1925 that mileage was reduced by 5000 miles. Now with that condition developing, you have increased your traffic, varying under certain conditions, 8 to 15 per cent. You have increased your axle load anywheres from 12 to 30 per cent, and increased your motor power and your car and train load in proportion, with less mileage. But you have another condition not reflecting in proportion to the increase in service.

I am not going to take any longer Mr. Chairman. In those savings of the railroads that I have quoted, of that 8 per cent of saving in labor, a great many things have been said, both with regard to saving in labor and material.

I feel that one of the greatest things that has been accomplished is the uniting and exchange of the ideas of the executives with the

employees. In the old days you used to go out to a wreck and all you could hear was language not expressed by Webster, and it was pretty brutal, and at the end of that battle you could make up your mind that one or more was going to be missing. Now those things have changed. By united effort, sitting around a round table and solving these things together, that has changed the whole condition.

I believe you have made the remark that this was the largest attendance at any similar conference. Now I imagine that is a recognition to you; they have come on your appeal; they have come on that recognition, but I think that the greatest recognition is that they have come here with the spirit of cooperation, trying to cooperate with you. With things that way I don't see why the percentage of service and conditions shouldn't be reflected similarly later on.

I also wish to say that I am frank in stating that when I came here I thought that I would be coming to more or less of a battle royal. We thought we were going to hear some expressions non-Webster, and the red flag going, but you haven't done that. In behalf of myself particularly, and all the gentlemen present, you have treated us with kindness and have given us a very cordial welcome. You have treated us like our good mothers have raised and reared their children, to develop into maturity, as one of God's chosen.

In closing I wish to state that we are in sympathy with the State and Federal rules and regulations, having the maker, the user and the neighbor cooperate with you in carrying them out in an educational way, with that fight of sheer stick-to-it-tiveness behind it, applying only the rule of horse sense.

I thank you. (Applause)

CHAIRMAN DORWORTH: There is one remaining subject, after which the Chair is going to submit a suggestion that has been advanced, and I hope that it will perhaps lead to something worth while. I am going to call on Mr. G. H. Friend, who will present a paper on the subject of "How Can Indifferent Railroad Organizations be Brought to Establish a Forest Fire Prevention Program?"

Mr. Friend. (Applause)

MR. G. H. FRIEND: Mr. Chairman and Gentlemen: I have been assigned the subject "How can Indifferent Railroad Organizations Be Brought to Establish a Forest Fire Prevention Program". With due apologies to the person or persons who assigned this subject to me, I want to emphatically state that to the best of my knowledge there does not exist today, within the Commonwealth of Pennsylvania, a railroad organization that is indifferent to the vitally important work of forest fire prevention.

For more than twenty years I have been a part of the organization of a railroad operating within the limits of this Commonwealth. During those years it has been my privilege to form a rather wide

acquaintance with members of other railroad organizations and upon various occasions during the past ten years it has been my privilege to join with officers of other railroads in formal and informal conferences here at Harrisburg, to discuss this important subject with your state officers, and at all of these conferences I have been impressed with the active, earnest interest displayed by railroad men in this constructive movement.

I do not for a moment contend that this interest has been entirely actuated by altruistic motives, for there are many selfish reasons why railroad managements are vitally interested in the elimination of forest fires.

You have a slogan "Everybody Loses When Timber Burns", and I want to say to you that no one loses quite so heavily when timber burns as do the railroads.

Railroad organizations, if for no other reason, are interested in the prevention of forest fires, because it pays to be interested; because prevention of forest fires means increased net on the balance sheet at the end of the year.

When timber burns the railroad loses:—

1. The amount of the damage claim that it must pay the property owner if the fire originated through fault of its own.
2. By the increased expenditure for cross-ties and other timber requirements when the supply is exhausted along its own lines.
3. By the loss of revenue from shipments of timber products originating along its lines.
4. By the increased expenditure for labor to clean from the ditches of its roadbed the soil eroded from the adjacent barren hills.
5. By increased expenditures for supplies of water suitable for use in locomotive boilers, occasioned by the drying up of supplies that were formerly suitable and adequate.
6. By severe periodical losses occasioned by floods which are primarily due to denuded mountain slopes. Only three years ago the Company which I represent suffered a loss of a million dollars from a flood that had its origin in the barren slopes of the Allegheny Mountains in Western Pennsylvania, West Virginia and Maryland.

I cannot conceive of any individual or corporation that loses so heavily and in so many ways as does the railroad company, when timber burns. Therefore, there are very good reasons why indifference does not exist in railroad organizations.

Now Mr. Chairman, if you will pardon a slight deviation from the subject that has been assigned to me, I will endeavor to offer some constructive suggestions upon the subject "How to create a more

effective interest on the part of railroad organizations in the movement for the prevention of forest fires".

I do not conceive that this objective can be attained by additional legislation. Interest born of legislation is usually negative rather than constructive. In all the affairs of life, action and effort prompted by enthusiastic interest in the result to be accomplished, has always been more effective than all the "thou shalts", and "thou shalt nots" that were ever written into statute books.

We now have adequate laws governing the burning of safety strips and the inspection and maintenance of locomotives. What we need is a more active interest on the part of railroad organizations in the protection of existing forests and the planting and cultivation of new forests, and a closer cooperation between railroad organizations, lumbermen's associations and state authorities in their efforts.

In our eastern states which enclose portions of the Appalachian Mountain systems within their boundaries, there cannot be, in my opinion, any public administrative policy that possesses greater merit, or one that holds out greater promise of reward in the way of lasting benefit to the state and its future citizens, than that of reforestation of the state's denuded mountain sides. The State of Pennsylvania has been particularly fortunate in having at present, and for many years past, executives who have fully realized the importance of this policy, who have been leaders in the movement, so that the traveler through the state, is today, not only impressed but thrilled with the beauty of the magnificent young forests that stand as monuments to those far seeing executives,—not cold, dead monuments of marble or bronze, but pulsing, living monuments, that hold in their branches, recreation, health and prosperity for unborn generations.

For many years the state authorities carried on their constructive efforts with very little cooperation from many railroad organizations, doubtlessly their attitude was for a long time indifferent, but gradually by constant and patient effort, the state authorities have awakened, what I believe to be an active interest on the part of the railroads and the question now to be considered is how to make that interest more effective.

A railroad organization includes the entire personnel from the president down to the section man who patrols the right-of-way, and the ash pit laborer who cleans the ash pans and closes the ash pan slides of locomotives.

The policies of the railroad originate with the executive officers; it is their increased interest, therefore, that must primarily be obtained in order to make more effective any activity, the success of which is dependent upon individual efforts of the personnel working under their direction.

The scope of the project of forest protection and reforestation is so extensive that the initiative in the movement, in the future, as in the past, must be assumed by federal and state agencies. It is through them that interest in the movement on the part of the railroad executives must be quickened. For the past few years it has been customary for the Governors of many of the states to meet together annually. These annual meetings should result in concerted effort in matters of mutual interest to the states represented. Through a concerted action of the state executive it is reasonable to presume that an organized cooperation on the part of railroads might be secured through the American Railway Association, working through a general committee of the association with sub-committees made up of railroad executives and operating officers in the various states, which sub-committees would work with the forestry departments of individual states.

Nothing is quite so productive of an active participation in any undertaking as for the individual to feel that he has a proprietary interest in the undertaking, and doubtlessly the same holds true of corporations. It would, therefore, seem beneficial if some system might be worked out whereby railroads would acquire a proprietary interest in the work of reforestation; an increased interest in forest protection and fire prevention would necessarily follow.

To place this suggestion in more concrete form:—One railroad, to my knowledge, owns thousands of acres of cut over and burnt over mountain lands. It would seem within the range of possibility that some arrangement might be worked out between the state authorities and the railroad whereby this land might be devoted to reforestation projects under state supervision, which arrangement would inure to the benefit of both the owner and the state. The owner might be made to immediately benefit by being exempted from taxation upon the land thus devoted to reforestation, for a term of years during the growing period, and both the owner and the state might share upon an equitable basis in the proceeds from the sale of forest products as they mature. The possession by a railroad of a proprietary interest in such a forest reservation, should automatically engender in its organization a more active interest in fire prevention for its protection.

Many things are now being done to create a greater interest among railroad employees in the subject of fire prevention. The practice of the state department's furnishing appropriate posters to be posted by section men has had a beneficial effect, as these posters bring to the attention of the section man the importance of the work in a way that had not occurred to him before. The practice of appointing section foremen as deputy fire wardens has, I think, also had a beneficial effect. The placing of caution notices in locomotive cabs dur-

ing the fire season, is a reminder to the crews to exercise due caution to prevent fires and to report promptly defective ash pan slides and front end netting.

There do not occur to me any means of combatting the fire hazard other than those now being employed. The only thing that seems to be required is by constant effort to educate the individual employee to greater vigilance and more effective effort.

For several years past the railroads have been carrying on such educational programs, and I believe that the decrease in forest fires due to railroad operations, demonstrates that beneficial results are being accomplished. (Applause)

CHAIRMAN DORWORTH: As I indicated previously, rather following out the thought of Mr. Friend's interesting paper, is a suggestion that has been made, after some informal discussion during the past two days, of having a committee come into existence representative of you railroad men and of the Department of Forests and Waters, to see if such a committee can work out still more practical ideas in line with combating railroad fires; to recommend such methods to the railroads, as not being in any sense binding but merely intended to blaze a way for finding more practical methods. I am not sufficiently informed as to whether there is any organized force among you to make recommendations for the committee if one should be decided upon. The suggestion has been that the committee shall consist of six, three representing the railroad men and three representing the Department of Forests and Waters, one of the three being the Chief Forest Fire Warden.

It would be interesting to hear some expressions of opinion, as to whether the suggestion is one that merits approval, whether you think it is one that should be given more thought; if so as to how best to proceed. I would be very glad to hear any thought on it.

MR. W. H. KILBY: Mr. Chairman and Gentlemen; If I may claim a privilege as a visitor and not be thought impertinent, there is always a tendency at the end of the conferences like this to remember certain features. I believe that the suggestion for a committee to continue the work of this Conference in your State is a good one.

It seems to me, speaking from some twenty years' experience as both a state officer and a railway officer, that in this Conference has been expressed every idea on forest protection, and there hasn't been one word of discord, particularly from the railroads against any right measures of applying that protection.

There does seem, and I say this with all due respect, a lack of coordination. It does seem that we have all learned something here, even those of us who have been particularly charged with this work in railroads. And I think the idea of a committee to formulate guid-

ance—I dislike the word organization, because as many of the speakers have brought out you cannot organize free-thinking men. You can guide them and direct them. They will always use their good horse sense, and I heartily agree with your suggestion.

I offer my apologies as a visitor to your State, but someone has to share these thoughts and pass them along.

CHAIRMAN DORWORTH: I thank you, Sir. Is there any other person who will give us the benefit of his thought on the subject? Is it one you want to go ahead with? I have no desire to intrude any thing that doesn't appeal to your sympathetic interests and better judgment. It is purely a cooperative thought.

MR. F. R. LAYNG: Mr. Chairman and Gentlemen: May I suggest that this idea of a committee seems to have some merit in it, and yet, without giving it further thought and consideration it would be rather difficult to pick three members to properly represent the railroads of the State. May I suggest that you take three of the roads that have a considerable mileage in the State, and ask their representatives to select representatives to consider this matter, and then come to you with constructive suggestions as to the forming of a permanent committee. Take a little more time, in other words, to think the thing out.

CHAIRMAN DORWORTH: I think that such a suggestion is very good. Is it the thought of the Group Conference that this selection be made by the Department of Forests and Waters? It seems to me that it would create a great deal more sympathetic interest by all the railroads if the suggestion did not come from the Department.

MR. LAYNG: May I suggest then, as a representative of one of the smaller roads of the State, that the Pennsylvania, the Reading and the B. & O. select each a man to confer with you on the matter of forming a permanent committee.

CHAIRMAN DORWORTH: What is the thought of the others here on this subject?

MR. COLBERT: Mr. Chairman and Gentlemen: I think that thought is all right, but in order to get the greatest scope the suggestion that I have is this, to select the three railroads in the State who have the greatest mileage through your forest territory. I don't mean by that any disrespect to any of the railroads referred to; it is only a suggestion on my part. Maybe the Shawmut might have the greatest mileage, and it may not.

CHAIRMAN DORWORTH: What would you think of such a committee being brought into existence upon the selection of the Chairman of this meeting, for such a committee to work out some plan of procedure and some additional practical methods of combating railroad fires, and submitting those recommendations to each person here today for their consideration? The matter could be very

well brought up for further discussion at some future meeting if we could keep it alive, and even in that way if it could keep alive some of the spirit brought out, some of the ideas advanced in these last two days, it will have served a very helpful purpose to say the least.

MR. LAYNG: Do I understand that you will select three representatives to confer with your Department?

CHAIRMAN DORWORTH: If the Group Conference will select the three railways and ask me to communicate with them for the selection of their representatives, I will be delighted to do it.

MR. LAYNG: Then, Mr. Chairman, I offer this resolution, that it is the sense of this meeting that the Chair be asked to select three representatives to meet with their representatives in connection with the forming of a permanent committee.

MR. KRELL: Mr. Chairman and Gentlemen: The thought occurs that perhaps three representatives would be insufficient. It might be well to increase that number to make your body more representative.

CHAIRMAN DORWORTH: The only difficulty about that is in getting them together.

MR. KRELL: I think that they would find that Harrisburg is a central place and can be reached without much difficulty.

MR. BYRNE: Mr. Chairman and Gentlemen: May I mention our experience in Minnesota? I am a stranger within the gates. If I may make a suggestion my suggestion would be that the railroad representatives be appointed as you said, but that the Forestry Department, on its part, appoint one man who devotes his entire time to railroad work, including the inspection of locomotives or burning strips and all the other work; devote his entire time to that and get concrete examples of failure on the part of railroads, and then have that individual confer with these members of the railroad committee and bring to them these specific instances, and after this goes on for one or two years then you can have a meeting and bring all these facts to light, where a company has actually been falling down, and where the system is not working properly you can take measures to remedy each defect that exists. That is the way it has worked out in Minnesota.

DR. VON SCHRENK: I don't think any of us here feel competent to select the ultimate personnel, and as I gather from Mr. Layng's motion we call upon you, from your knowledge of railroad mileage and distribution in Pennsylvania, to select the three railroads. I feel confident that all the other railroads will be perfectly agreeable to have you request these three railroads to get together and study this question with the view point of their suggesting a group committee to represent the railroads. They may not want those three railroads but nobody is going to kick about that. But in order to get

something going, pick out three railroads, and say that it is the sense of this Conference that this is a preliminary working committee.

CHAIRMAN DORWORTH: May the Chair ask you to amend that to the extent of empowering the Chair to modify that Committee, if found advisable? Do you make that as a motion?

MR. LAYNG: Yes, I make that as a motion.

There was a call for the question and upon being duly seconded, it was put to a vote and carried.

DR. VON SCHRENK: Mr. Chairman, before you conclude the Conference may I have the floor a minute?

I think I can feelingly speak what is in the minds of probably all the railroad representatives here, after these two days of very interesting discussion, and I would like to have the privilege of presenting a resolution, sir.

"Whereas, The Department of Forests and Waters, Commonwealth of Pennsylvania, has called this Conference for the discussion of Forests and Forest Protection; and

"Whereas, We have been impressed with the breadth of view, spirit of cooperation shown by this Department, and the same and helpful methods of administration; and

"Whereas, We have been impressed by the careful planning of this Conference and the wide and general scope of the papers presented; and

"Whereas, We believe that these discussions will lead to a wider interest and appreciation of our mutual responsibilities and opportunities for public service; therefore be it

"RESOLVED, That we, the delegates of the railroads here represented express our appreciation to the Department of Forests and Waters for calling this meeting, and for the benefits that we have all secured from the discussions and the variety of papers presented; and be it further

"RESOLVED, That we pledge to them our whole-hearted support in the future in their efforts to conserve and renew the forest resources of Pennsylvania."

MR. LAYNG: I move the passage of that resolution.

The motion was duly seconded, was put to a vote and carried.

CHAIRMAN DORWORTH: If there are no further comments on any subject I would like to say that the Secretary of the Department of Forests and Waters, and the Chief Forest Fire Warden, express appreciation of your very kindly phrased resolution just adopted; that the Department appreciates to the very fullest not only your presence here at this Conference, but the significance of your presence. We feel that much good has been accomplished and we feel that it augurs well for the years to come. The Department of Forests and Waters is planning on a broader scale for the coming

year. The cooperation of you men as railroad men will be an important factor in determining whether or not our broadening of plans is to be met with the success that we hope for. In a personal sense I want to thank you all for your very close attention to the proceedings, and I trust that they have been half as interesting to you as they have been to me, and as I know they have been to Mr. Wirt, the main-spring in the Forest Fire Protection Service in this Department.

With this closing word I wish to ask that this meeting come to a close.

The meeting adjourned at four-forty-five o'clock.

PENNSYLVANIA FOREST FIRE STATISTICS— SUMMARY BY CALENDAR YEARS

Year	Number of Fires	Area Burned Acres	Average Area Per Fire Acres	Amount Damage	Cost to State for Extinction
1913	937	386,267.55	412.00	\$719,426.67	\$26,683.88
1914	1182	360,236.45	305.00	717,573.23	31,318.44
1915	1079	340,621.70	316.00	874,557.79	27,150.79
1916	1012	143,294.90	141.00	253,025.30	13,760.86
1917	1902	286,108.53	150.00	550,831.17	27,160.28
1918	1625	227,484.97	140.00	410,637.40	25,374.83
1919	950	126,626.07	133.29	279,395.50	13,264.79
1920	1597	256,158.21	160.39	1,007,868.30	43,105.97
1921	2409	188,535.97	78.26	329,738.64	60,941.12
1922	3635	332,326.72	91.42	670,149.11	185,041.77
1923	3539	375,737.11	105.17	794,727.37	158,825.45
1924	1997	95,792.26	47.97	204,296.60	63,793.35
1925	2562	125,150.56	48.85	380,357.64	85,777.64
1926	2917	224,255.60	76.88	1,186,326.65	177,353.41

NUMBER OF FOREST FIRES BY YEARS AND CAUSES 1917-1926

Year	Railroads	Brush Burning	Incendiary	Transient	Lumbering	Lightning	Misc.	Unknown	Total
1917	585	141	116	134	37	2	41	846	1,902
1918	492	115	118	99	46	6	162	587	1,625
1919	250	77	76	118	28	3	20	378	950
1920	553	104	128	218	44	4	25	521	1,597
1921	996	139	101	127	16	11	85	934	2,409
1922	1,071	244	291	1,218	50	3	161	597	3,635
1923	1,257	212	178	1,062	65	22	245	498	3,539
1924	541	92	124	650	7	8	209	366	1,997
1925	656	283	218	737	31	62	230	345	2,562
1926	891	266	189	865	47	22	265	432	2,917
10-year average	729	167	154	517	37	14	144	551	2,313

FOREST FIRES CAUSED BY RAILROADS 1913-1927

Year	Number of Fires	Percent of Total Number	Area	Percent of Total area Burned	Damage	Percent of Total Damage	Cost of Extinction	Percent of Total Cost
1913	211	22.5	70,022.20	18.128	\$114,538.51	15.918	\$4,140.63	15.517
1914	254	21.5	45,736.00	12.696	79,639.60	11.098	3,865.50	12.343
1915	270	25.0	62,582.75	18.373	189,506.72	21.669	5,167.36	19.032
1916	250	24.7	17,294.85	12.069	44,467.80	17.574	1,611.75	11.713
1917	585	30.7	50,308.39	17.584	128,591.80	23.345	4,657.55	17.148
1918	492	30.3	58,565.10	25.745	120,072.75	29.241	4,491.10	17.699
1919	250	26.316	11,660.95	9.209	15,060.50	5.39	1,246.48	9.397
1920	553	34.627	65,567.81	25.597	420,235.90	41.696	8,016.34	18.597
1921	996	41.345	63,019.20	33.425	106,250.31	32.223	13,291.65	21.811
1922	1071	29.463	83,352.23	25.081	192,718.55	28.758	39,492.50	21.343
1923	1257	35.520	124,799.28	33.220	233,945.16	29.437	44,046.68	27.730
1924	541	27.090	19,466.69	20.322	33,535.60	16.415	8,533.65	13.380
1925	656	25.610	21,080.94	16.844	64,707.15	17.012	11,490.37	13.395
1926	891	30.545	41,952.85	18.700	116,282.85	9.801	32,333.99	18.231
1927*	254	20.566	7,813.36	20.686	14,580.05	15.258	4,007.02	14.003

*—Incomplete



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END OF NUMBER